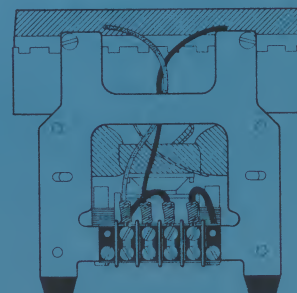
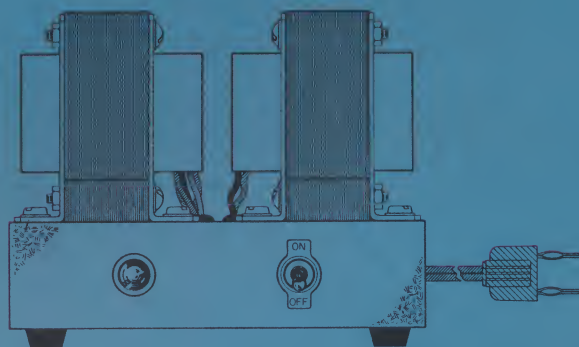


SAMBION

THERMOELECTRICS

... assemblies

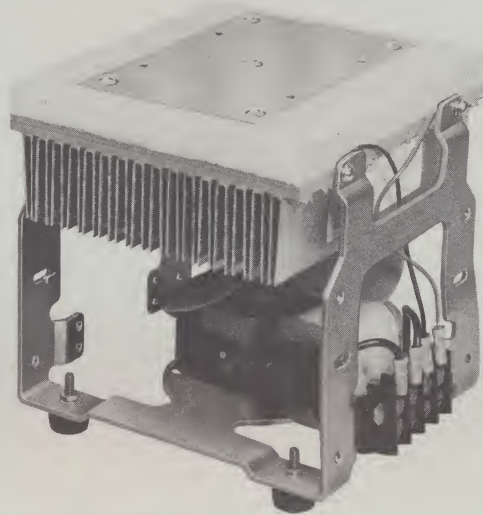


CAMBION®

technical data

Model
3970-1

40 Watt, Forced Convection
Thermoelectric Assembly



PERFORMANCE

Model 3970-1 is a thermoelectric cooling assembly capable of pumping a maximum of 40 watts (136 BTU's/hr). The thermoelectric components are "sandwiched" between an aluminum heat sink and an aluminum cold plate. This unit is mounted to a free-standing bracket which contains the fan. A 50 °C temperature differential between the heat sink and the cold plate is attainable with this assembly.

FEATURES

Model 3970-1 offers an accurate, low cost cooling source which is designed to fit into other systems with a minimum of alterations. Although the thermoelectric components are arranged in series within each assembly, parallel or multiple series connections can be achieved from unit to unit.

APPLICATIONS

In systems where temperature control is desired, as in ferrite memory cores, oil baths, power supply components, ground support equipment, CAMBION 3970-1 can readily become a component part.

ACCESSORIES

Fixed output power supply, Model 3971-1 is recommended for use with the 3970-1.

In the interests of improved design and performance, Cambridge Thermionic Corporation reserves the right to make changes in its specifications without prior notice.

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70222

A	4.375
B	5.00
C	4.312
D	2.75

General Characteristics

5.5 dc amperes

9.0 dc volts

$Q_c = 38$ watts at $0^\circ\text{C } \Delta T$, or
 $45^\circ\text{C } \Delta T_{\text{min.}}$ *, atmospheric
 pressure.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

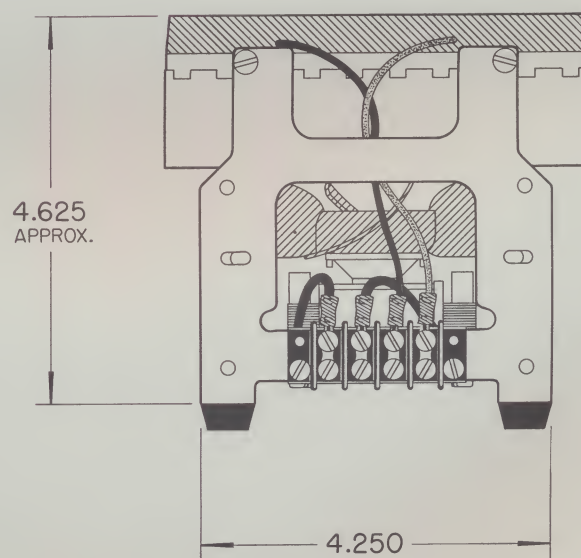
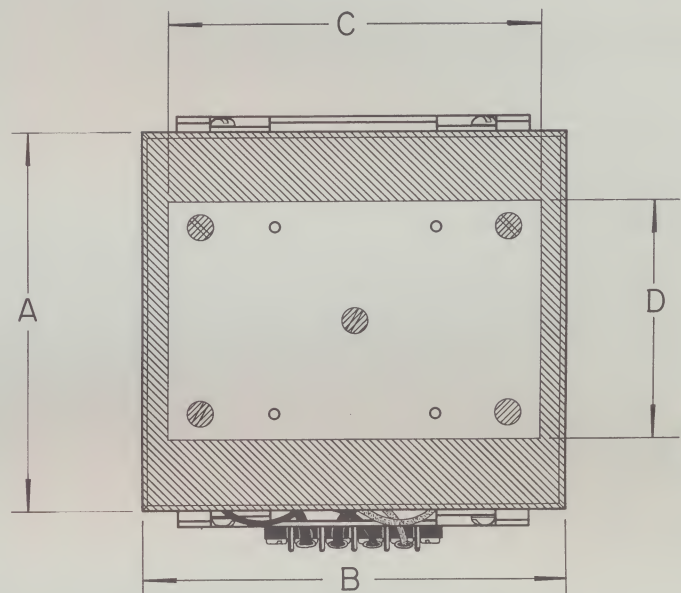
$$\Delta T = T_s - T_c.$$

$\Delta T_{\text{min.}}$ as used above, describes the minimum temperature differential obtained under no heat load conditions at the prescribed current input. Data was taken in still air, at atmospheric pressure, with an ambient temperature of 24°C .

Some application requirements are:
 AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts). For optimum performance, fan must be located to utilize adequate air sources.

Model 3970-1 is also available in modular form without the fan and bracket.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

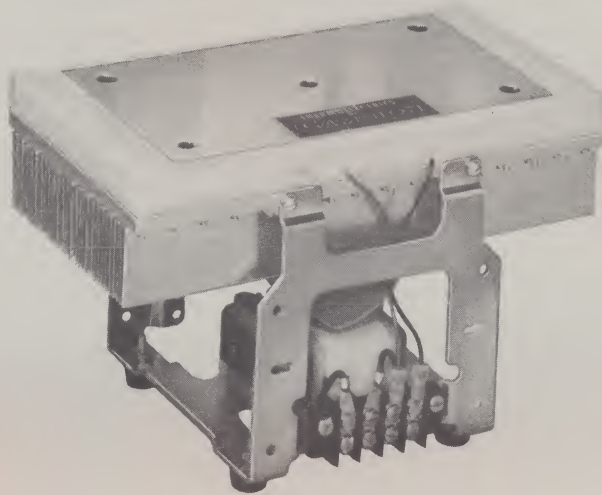


CAMBION®

technical data

Model
7250-1

80 Watt, Forced Convection
Thermoelectric Assembly



PERFORMANCE

Model 7250-1 is a thermoelectric cooling assembly capable of pumping a maximum of 80 watts (272 BTU's/hr.). The thermoelectric components are "sandwiched" between an aluminum cold plate and a staked aluminum heat sink. This unit is mounted to a free-standing bracket which contains the fan. A 50°C temperature differential between the heat sink and the cold plate is attainable with this assembly.

FEATURES

In addition to performance features, Model 7250-1 offers a relatively large cooling surface. The cold plate is rectangular and yields an area of 24.375 square inches.

APPLICATIONS

Model 7250-1 is a versatile assembly. It may be used in the science classroom to demonstrate thermoelectric principles, to control the temperature of specimens; in the laboratory to control the temperature of saline and other solutions, photographic films, etc.; or in production for maintaining epoxy systems, cooling electronic components under test, and a wide variety of other uses.

ACCESSORIES

Variable DC power supply, Model 7230-1 is suggested for use with the 7250-1 assembly.

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70219

General Characteristics

5.5 dc amperes

18 dc volts

$Q_c = 76$ watts at $0^\circ\text{C } \Delta T$, or
 $45^\circ\text{C } \Delta T_{\text{min.}}$ *, atmospheric
 pressure.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

$$\Delta T = T_s - T_c$$

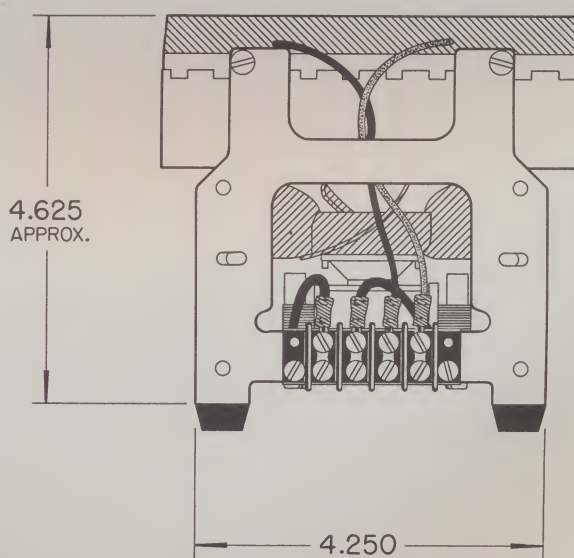
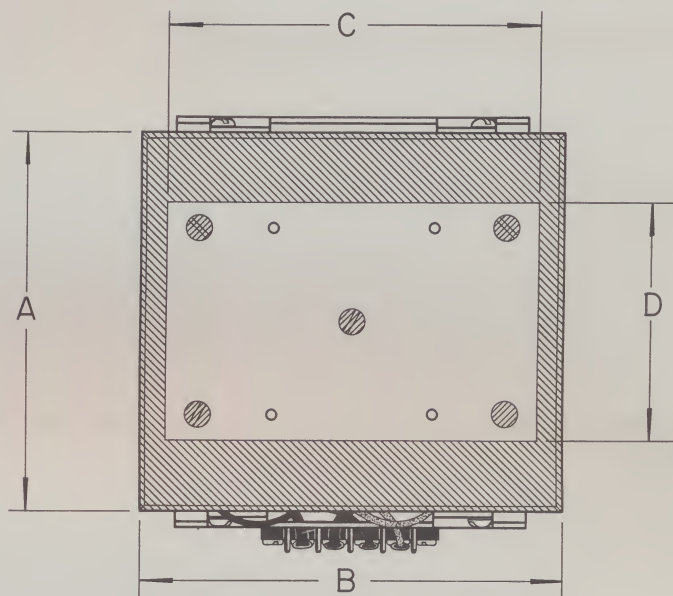
$\Delta T_{\text{min.}}$ as used above, describes the minimum temperature differential obtained under no heat load conditions at the prescribed current input. Data was taken in still air, at atmospheric pressure, with light insulation on the cold plate.

Some application requirements are:
 AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts). For optimum performance, fan must be located to utilize adequate air sources.

Model 7250-1 is also available in modular form without the fan and bracket.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

A	4.375
B	8.00
C	6.50
D	3.75



CAMBION technical data

Model
7251-1

120 Watt,
Forced Convection
Thermoelectric Assembly



PERFORMANCE

Model 7251-1 is a thermoelectric cooling assembly capable of pumping a maximum of 120 watts or 408 BTU's/hour at a 0°C temperature differential. The thermoelectric components are "sandwiched" between an aluminum cold plate and a staked copper heat sink to yield optimum performance characteristics and design compactness. The heat sink unit is supported over a boxer fan by a shroud containing a terminal strip. The terminal strip provides an easily accessible means for hook-up of the power supply (not included) and the fan.

FEATURES

Model 7251-1 features a large, flat cooling surface. Cooling over this plate is remarkably uniform, thus allowing the total area to be utilized. Not only is cooling uniform, but it is fast as well. It requires less than five minutes to freeze the cold surface (no load condition, open ambient).

APPLICATIONS

The high heat pumping capacity offered by Model 7251-1 renders it ideal for fixing by freezing small biological specimens to facilitate sectioning, or in another situation, silicon chips for dicing. It is also suitable for cooling solutions such as those used in nerve response studies, or to maintain two part resin epoxy systems below a critical maximum temperature...and the list continues, limited only by lack of imagination!

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General Characteristics

6.0 dc amperes

28 dc volts

$Q_c = 114$ watts at $0^\circ\text{C } \Delta T$, or
 $45^\circ\text{C } \Delta T_{\text{min.}}$ *, atmospheric
pressure.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

$$\Delta T = T_s - T_c.$$

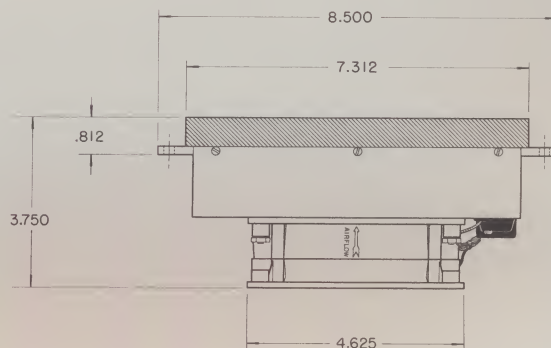
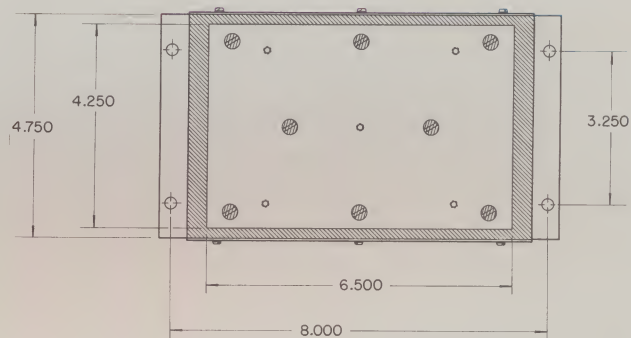
$\Delta T_{\text{min.}}$ as used above, describes the minimum temperature differential obtained under no heat load conditions at the prescribed current input. Data was taken in still air, at atmospheric pressure, with light insulation on the cold plate.

Some application requirements are:
AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts). For optimum performance, fan must be located to utilize adequate air sources.

Model 7251-1 is also available in modular form without the fan and shroud.

Variable DC power supply, Model 7230-1, is suggested for use with the 7251-1.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.



CAMBION® technical data

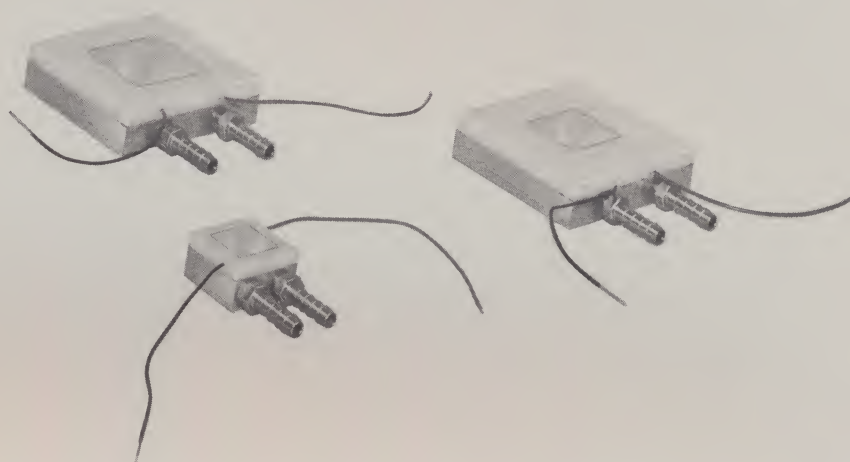
Models

7240-1

7241-1

7242-1

Single Component,
Water Cooled Assemblies



PERFORMANCE

Each model has unique performance characteristics because of the differences inherent in the thermoelectric components utilized, yet a common factor lies in the use of a water cooled heat sink.

Model	Input DC Amp.	Heat Pumping Capacity	Heat Sink Dimensions
7240-1	5.5	8 watts, 27.2 BTU's/hr.	1 1/4 x 1 1/4 x 2
7241-1	6.0	13.5 watts, 45.9 BTU's/hr.	3 x 3 x 1/2
7242-1	6.0	19 watts, 64.6 BTU's/hr.	3 x 3 x 1/2

FEATURES

These models are compact. Surface areas ranging from 9/16 square inch (7240-1), to 1 9/16 square inches (7241-1), to 2 1/4 square inches (7242-1) make high heat pumping capacity spot cooling available.

APPLICATIONS

Models 7240-1, 7241-1, and 7242-1 are ideal for small scale biological, medical, general laboratory, and production test situations. Specific examples include the chilling of solutions used in nerve response studies and the freezing of silicon chips to facilitate dicing operations.

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General Characteristics

7240-1	5.5 dc amperes 2.6 dc volts $Q_c = 8$ watts at $0^\circ\text{C } \Delta T$, or $45^\circ\text{C } \Delta T_{\text{min.}}$, * at- mospheric pressure at minimum water flow rate of 100 ml/minute.
7241-1	6.0 dc amperes 3.2 dc volts $Q_c = 13.5$ watts or $45^\circ\text{C } \Delta T_{\text{min.}}$, atmospheric pressure at minimum water flow rate of 400 ml/ minute.
7242-1	6.0 dc amperes 4.8 dc volts $Q_c = 19$ watts or $45^\circ\text{C } \Delta T_{\text{min.}}$, atmospheric pressure at minimum water flow rate of 500 ml/ minute.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

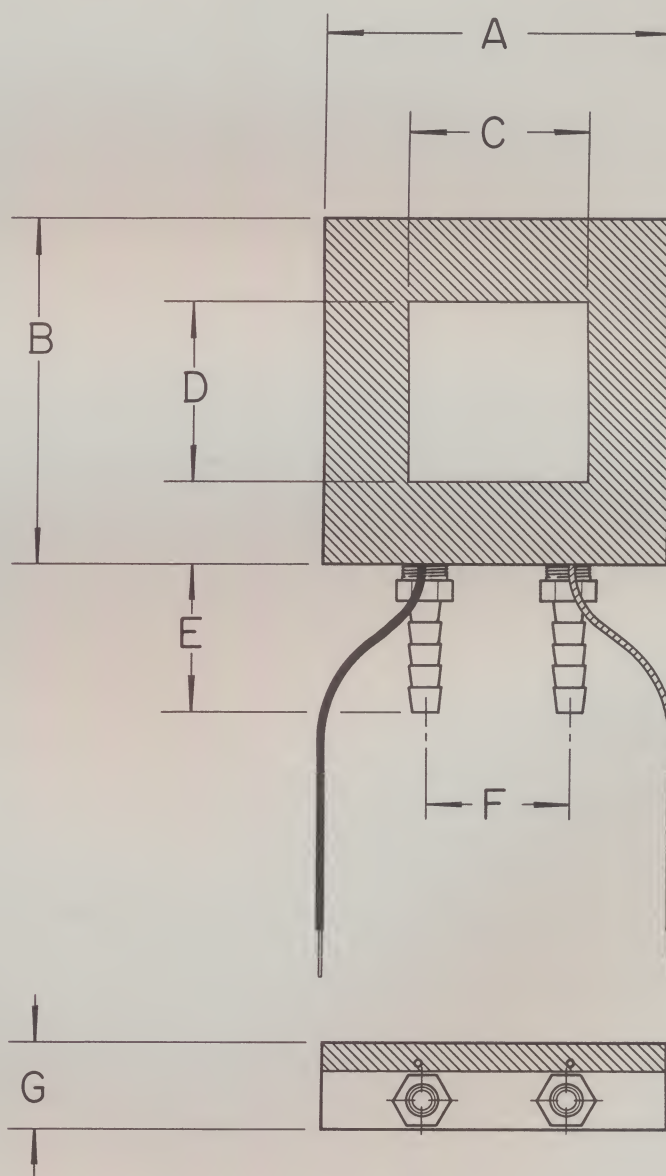
$$\Delta T = T_s - T_c$$

$\Delta T_{\text{min.}}$, as used above, describes the minimum temperature differential obtained under no heat load conditions at prescribed water temperatures and flow rates. Data was taken with water temperature at 20°C . Both water temperature and flow rate affect performance.

Some application requirements are:
AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

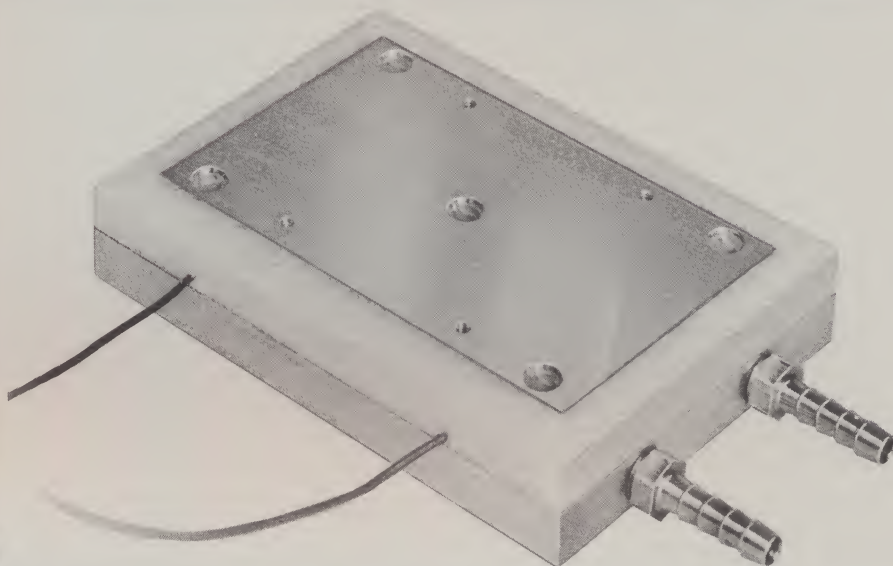
	7240-1	7241-1	7242-1
A	1.25	3.0	3.0
B	1.25	3.0	3.0
C	0.75	1.18	1.5
D	0.75	1.18	1.5
E	$1.25^{\pm .25}$	$1.25^{\pm .25}$	$1.25^{\pm .25}$
F	0.625	1.25	1.25
G	0.68	0.75	0.75



CAMBION[®] latest developments

Model
7243-1

40 Watt, Water Cooled
Thermoelectric Assembly



PERFORMANCE

CAMBION'S Model 7243-1 closely corresponds to Model 3970-1. Like the 3970-1, 7243-1 has a maximum heat pumping capacity of 40 watts (136 BTU's/hr). However, in the case of Model 7243-1, heat from the thermoelectric components is dissipated across a water cooled heat sink. The 7243-1 operates at a maximum of 6.0 dc amperes at approximately 8.6 dc volts. Performance varies with the input.

FEATURES

Where a water source is available, Model 7243-1 offers a distinct advantage over the forced convection type assembly. By utilizing a water cooled heat sink, cold plate temperatures may be brought down to -25°C or less with the heat sink at 20°C or less, a full 10° colder than with the corresponding forced convection assembly, 3970-1.

APPLICATIONS

Model 7243-1 is inherently compact and lends itself to a variety of applications. Included among these are: high capacity spot cooling for components; stabilizing two part resin epoxy systems; controlling the temperature of biologicals; fixing by freezing, silicon chips to facilitate dicing; and preparing experimental specimens for cryosurgery.

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70223

General Characteristics

6.0 dc amperes

8.6 dc volts

$Q_c = 38$ watts at $0^\circ\text{C } \Delta T$, or
 $45^\circ\text{C } \Delta T_{\text{min.}}$ * atmospheric
 pressure, at minimum water
 flow rate of 400 ml/minute.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

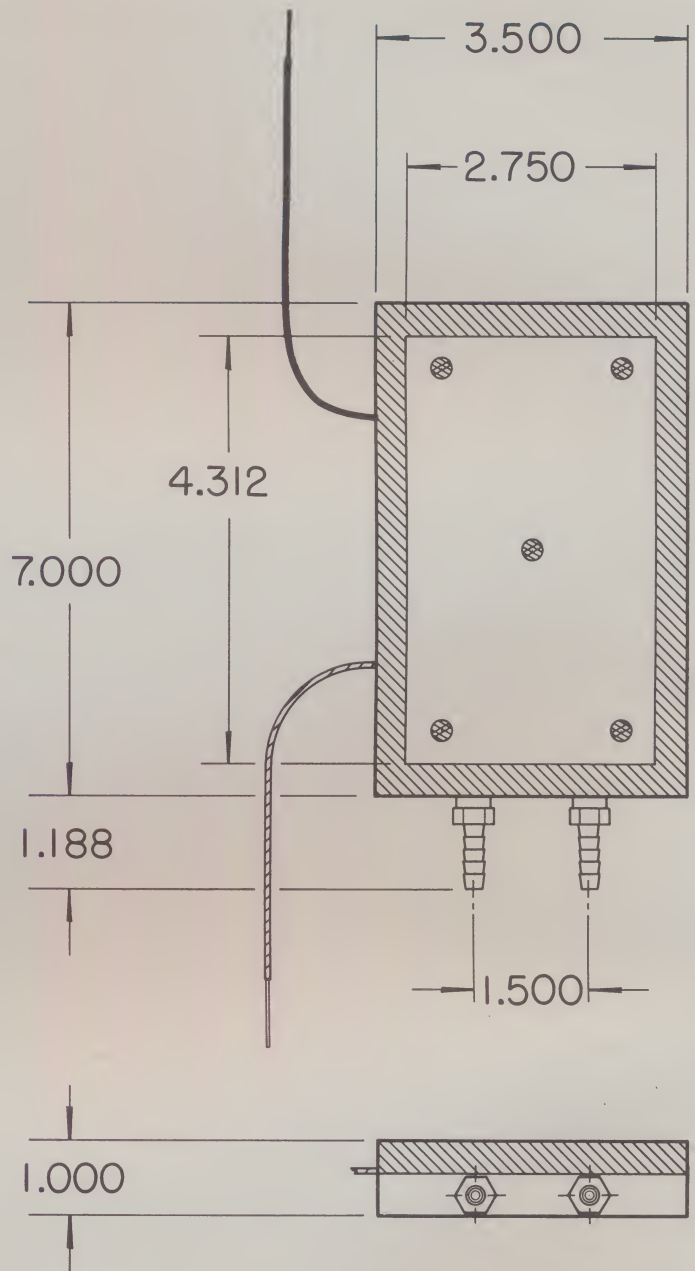
$$\Delta T = T_s - T_c.$$

$\Delta T_{\text{min.}}$ as used above, describes the minimum temperature differential obtained under no heat load conditions at prescribed water temperatures and flow rates. Both water temperature and flow rate affect performance. Data was taken with the water temperature at 20°C .

Some application requirements are:
 AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

Variable power supply, Model 7230-1, or fixed output Model 3971-1 are suggested for use with the 7243-1.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

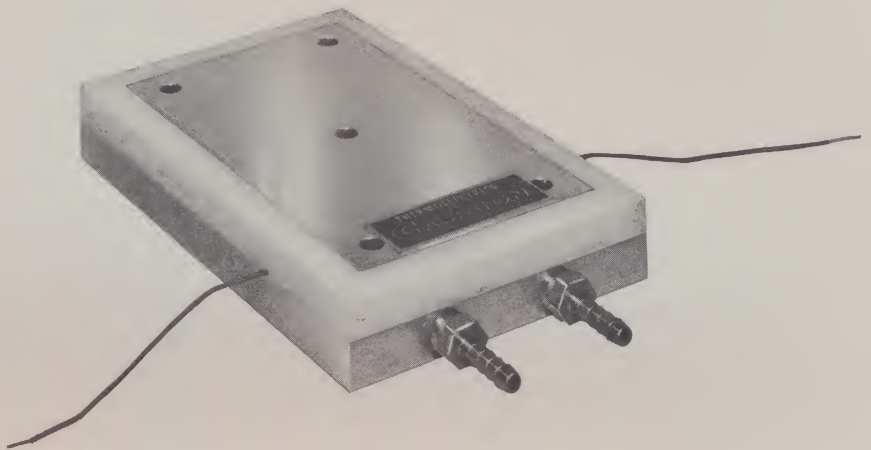


CAMBION®

technical data

Model
7244-1

80 Watt, Water Cooled
Thermoelectric Assembly



PERFORMANCE

Second largest in CAMBION'S line of water cooled thermoelectric assemblies, Model 7244-1 has a maximum heat pumping capacity of 80 watts (272 BTU's/hour). Heat from the thermoelectric components is dissipated across a water cooled heat sink. Model 7244-1 operates at a maximum of 6.5 dc amperes. Performance varies with the input current, and with the water temperature and flow rate.

FEATURES

Model 7244-1 capitalizes on the performance characteristics afforded by the water cooled heat sink to offer a lower temperature range than is attainable with forced convection heatsinks. Temperature differentials between the heat sink and the cold plate are equivalent for both types but with the water cooled heat sink, colder temperatures are possible.

APPLICATIONS

Potential applications are unlimited. They may be found in the biological, medical and general laboratory as well as in the production set-up. Some applications are: the temperature control of solutions used in nerve response studies, the control of saline solutions for biological experiments, freezing semiconductor slices for production slicing, and control of electrical components under test.

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70217

General Characteristics

6.5 dc amperes

18 dc volts

$Q_c = 76$ watts or $48^\circ\text{C } \Delta T_{\text{min.}}$ *
atmospheric pressure, at minimum water flow rate of 500 ml/minute.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

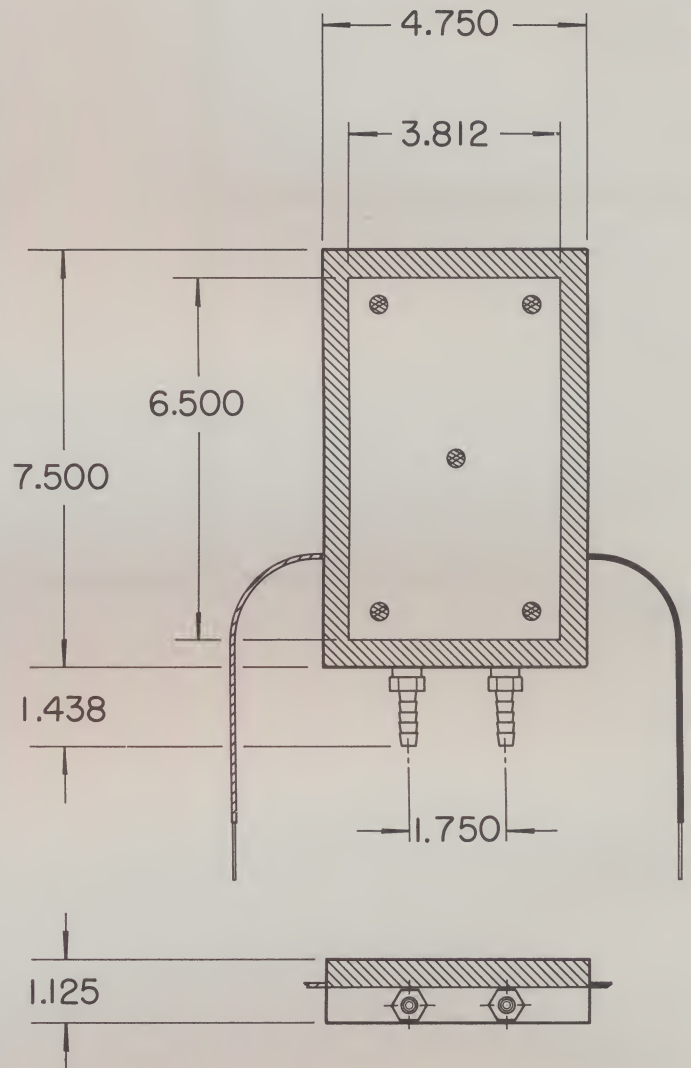
$$\Delta T = T_s - T_c.$$

$\Delta T_{\text{min.}}$ as used above, describes the minimum temperature differential obtained under no heat load conditions at prescribed water temperatures and flow rates. Data was taken with water temperature at 20°C . Both water temperature and flow rate affect performance.

Some application requirements are:
AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

Power supply, Model 7230-1, is a recommended accessory for the 7244-1.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

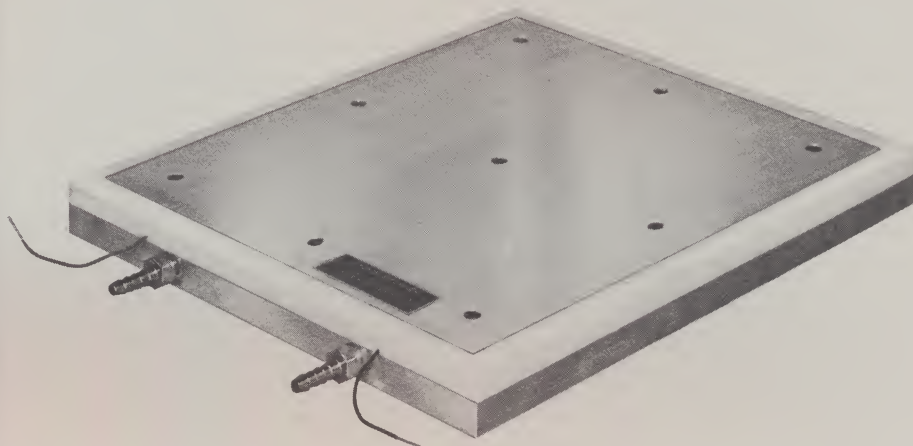


CAMBION®

technical data

Model
7245-1

120 Watt, Water Cooled
Thermoelectric Assembly



PERFORMANCE

Model 7245-1 is a thermoelectric cooling assembly capable of pumping a maximum of 120 watts or 340 BTU's/hour at a 0°C temperature differential. The thermoelectric components are "sandwiched" between an aluminum cold plate and a water cooled aluminum heat sink to give optimum performance characteristics over lower temperature ranges than those offered by forced convection assemblies.

FEATURES

Cold plate size is at a premium: 12" x 10". (Customized cold plates to meet specific application requirements may be obtained at additional cost.) Cooling over this plate is uniform, thus allowing the total area to be utilized. Cooling is fast, too. It requires less than five minutes to freeze the cold surface under a no heat load condition.

APPLICATIONS

The large surface and high heat pumping capacity combine to provide the capability to control the temperature of such diverse materials as saline solutions for biological experiments, silicon chips to aid dicing operations, printing inks to maintain viscosity, photographic film containers to maintain film below a critical maximum temperature. Potential applications are unlimited in the bio-medical or general laboratory, and in production line testing set-ups.

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General Characteristics

6.0 dc amperes

25 dc volts

$Q_c = 114$ watts or $40^\circ\text{C } \Delta T_{\text{min.}}$ *
atmospheric pressure, at minimum water flow rate of 1500 ml/minute.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

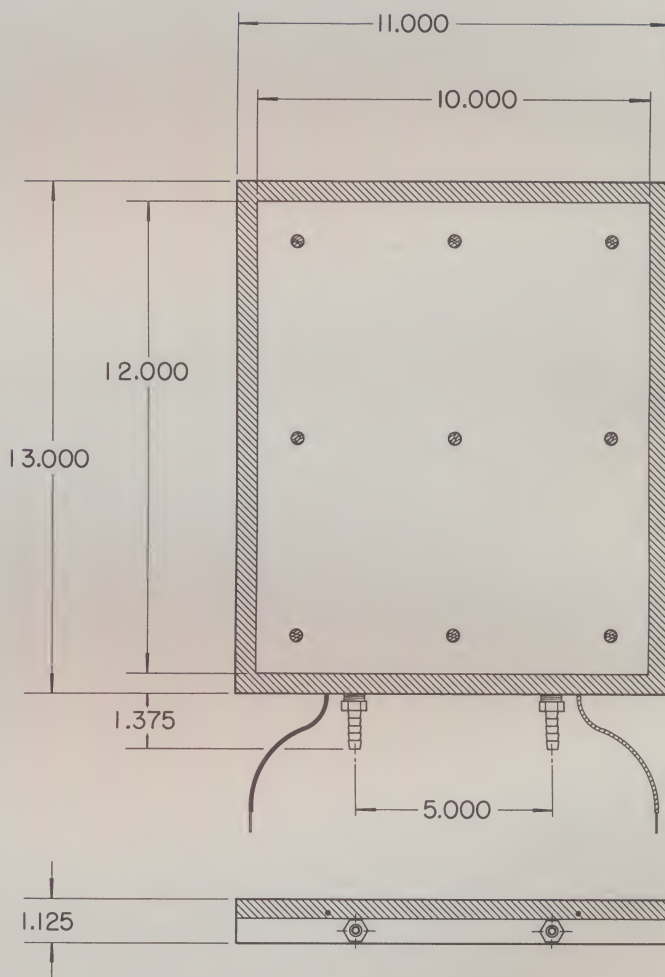
$$\Delta T = T_s - T_c.$$

$\Delta T_{\text{min.}}$ as used above, describes the minimum temperature differential obtained under no heat load conditions at prescribed water flow rates and temperatures. Data was taken with water temperature at 20°C . Both water temperature and flow rate affect performance.

Some application requirements are:
AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

Power supply, Model 7230-1, is a recommended accessory for the 7245-1.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.



CAMBION®

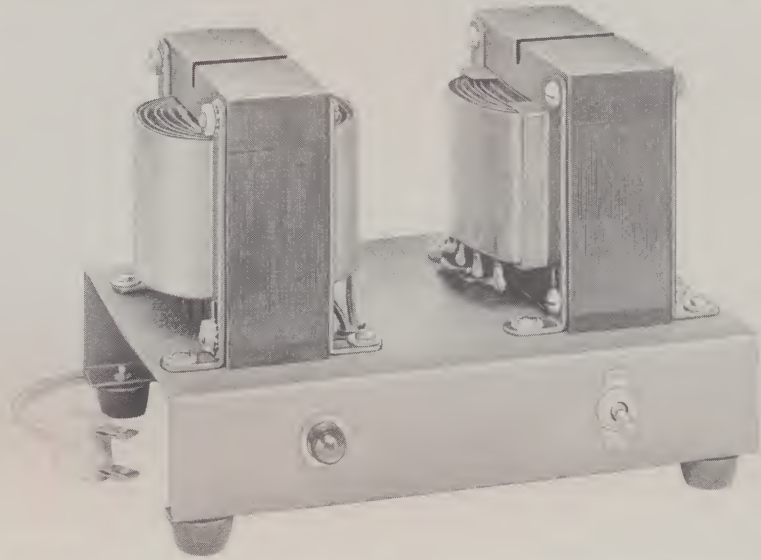
technical data

Models

3971-1, 3972-1,
3973-1, 3974-1

New CAMBION (R)

FIXED OUTPUT,
NON-REGULATED
DC POWER SUPPLIES



PERFORMANCE

Models 3971-1, 3972-1, 3973-1, and 3974-1 are fixed output, non-regulated DC power supplies designed to fit TED cooling requirements. These static magnetic power supplies provide the low-voltage, low ripple power required in most thermoelectric cooling applications, yet they operate from a standard 110/120 volt, 60 cycle source.

DESCRIPTION

All fixed output models are mounted on a steel chassis finished with blue wrinkle paint. Chassis size is convenient (approx. 6"x5"x1 1/2") with an overall height of five inches. All demonstrate full wave, half bridge rectification circuits with a filter choke in series with the output. Filter choke size is dependent on the acceptable level of AC ripple allowable for TED operation before performance degradation occurs.

OUTPUT

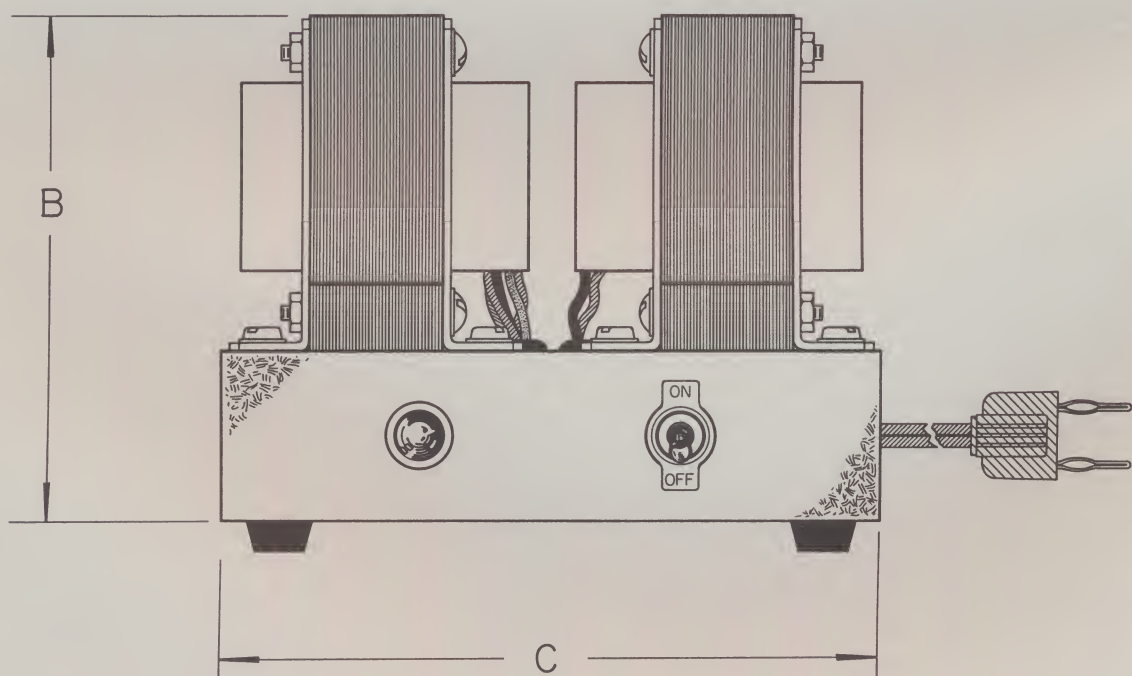
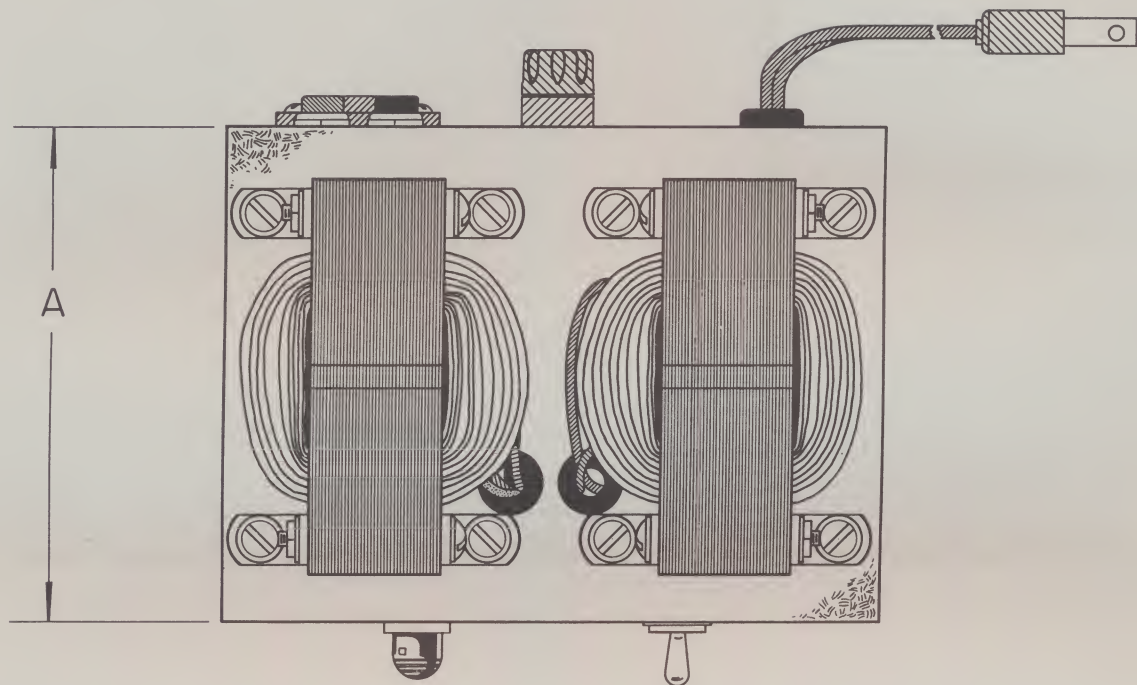
MODEL	V.	A.	Max. Ripple %	For use with:
3971-1	12.0	6.5	10%-15%	3970-1
3972-1	7.0	6.5	10%-15%	3951-1
3973-1	2.6	6.5	10%-15%	3950-1
3974-1	2.2	1.5	10%-15%	3952-1

APPLICATIONS

DC power supplies have been developed to provide low voltage power sources for TE cooling applications utilizing standard TED's.

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	3971-1	3972-1	3973-1	3974-1
A	4.75	4.75	4.75	3.50
B	4.75	4.75	4.25	2.75
C	6.25	6.25	6.25	5.00



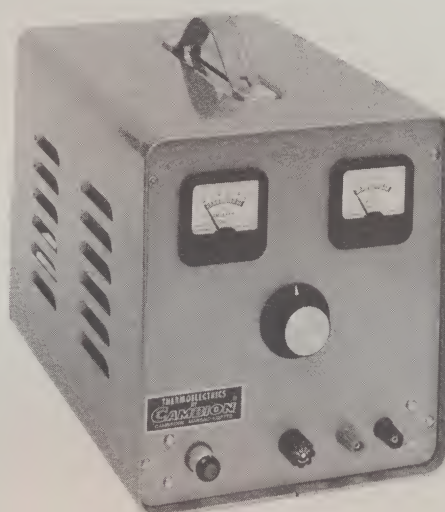
CAMBION® technical data

Model

7230-1

New CAMBION (R)

VARIABLE
DC
SOLID STATE
POWER SUPPLY



PERFORMANCE

Developed to meet the desired low-voltage power requirements of TED* applications, Model 7230-1 is a direct current power supply featuring controlled variable output.

FEATURES

Model 7230-1 has a set point range of 0 to 36 volts DC at 0 to 6 amperes DC. It operates from a standard 110/120 volt, 60 cycle source at approximately 3 amperes with a maximum ripple of 8% in the DC output voltage. In addition, Model 7230-1 has utmost portability in its one-piece aluminum cabinet complete with carrying strap. A recessed aluminum front panel serves to protect meters and controls.

APPLICATIONS

"Versatile" is the keyword to describe the 7230-1 power supply. This model is capable of operating any of CAMBION's standard TED's and can handle as many as six 3951-1's in series. Its range, coupled with its space-saving cabinet, allows it to be utilized in situations where other power sources are either inadequate or inconvenient, and also makes it possible to transfer it from one application to another with minimal inconvenience.

*Thermoelectric Device

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CAMBRIDGE THERMIONIC CORPORATION

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Los Angeles, California 90045

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TWX (910) 328-6169

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CAMBRIDGE THERMIONIC OF CANADA, LTD.

144 Ronald Drive
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Telephone (514) Hunter 8-9114
TWX (610) 421-3640

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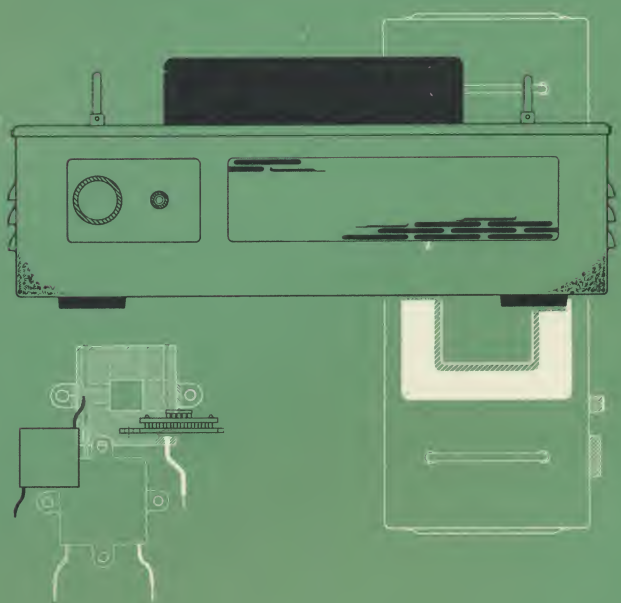
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Castleton, Near Sheffield, England
Telephone Hope 406/407
TELEX 54444

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THERMOELECTRICS

... instruments



CAMBION®

technical data

Model
7200-1

Non-Variable Control
Laboratory Cold Plate



PERFORMANCE

Model 7200-1 is a fixed performance thermoelectric cold plate designed to provide below ambient cooling and to maintain a 40 watt (136 BTU's/hr) load at ambient temperature. The 7200-1 does not feature a set point range, therefore, performance is dependent on heat loads and ambient fluctuations.

FEATURES

However, the 7200-1 does feature plug-in readiness. It operates from a standard 110/120 AC volt source with no additional equipment or power sources necessary. Size of the 7200-1 is conveniently compact; it lends itself to limited space applications and to portability.

APPLICATIONS

CAMBION'S Model 7200-1 is particularly useful in the medical, biological, and general laboratory to facilitate preserving perishables by providing a dependable constant cooling source. Model 7200-1 has been referred to as the antithesis to the hot plate to be employed wherever there is need for a constant cold source.

ACCESSORIES

Insulated cover, Model 7205-1, is available for the 7200-1.

In the interests of improved design and performance, Cambridge Thermionic Corporation reserves the right to make changes in its specifications without prior notice.

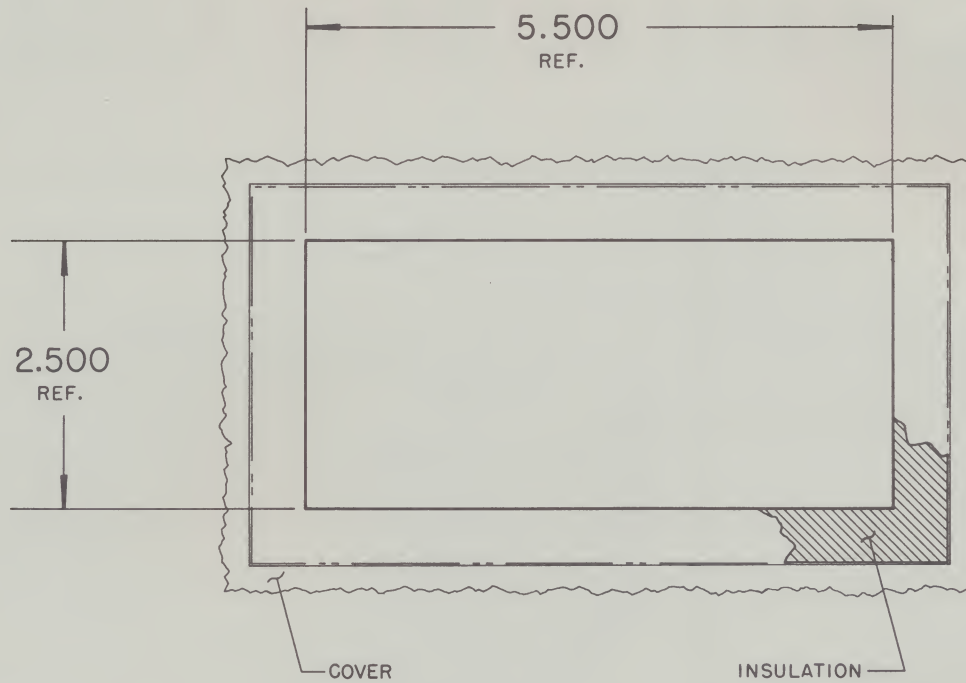
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70224

Top View of a 7200-1 Cold Plate



GENERAL CHARACTERISTICS

Model 7200-1 operates from a standard 110/120 AC volt source (60 Hz), and consumes a maximum of 100 AC watts.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature.

Limitations: Heat sink to cold plate temperature differential 40 °C (72 °F).

CAMBION'S 7200-1 is a self-contained thermoelectric cold plate with an internal power supply. The thermoelectric cold plate provides a reliable thermal source capable of reaching -10 °C under a no heat load condition.

Insulated cover, Model 7205-1, is available for the 7200-1. This cover isolates items being cooled from all ambient fluctuations and it is easily removed when its use is not desired.

PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 5 1/2"
Weight: ~17 lbs.

Cold plate surface area: 14 square inches.

Model 7200-1 is ruggedly constructed. Its outer shell is steel with a handsome wrinkle-paint finish. The lid and handles are both stainless - functional and attractive.

For additional information concerning characteristics and/or applications in specific systems, consult the thermoelectric engineering staff at CAMBION.

CAMBION®

technical data

Model
7201-1

Non-Variable Control
Thermal Bath



PERFORMANCE

CAMBION'S Model 7201-1 is a non-variable control thermal bath capable of maintaining a 40 watt load at ambient temperature. The 7201-1 does not feature a set point range and control, therefore, performance is dependent on heat loads and ambient temperature fluctuations.

FEATURES

Like the other models in CAMBION'S instrumentation line, the 7201-1 operates from a standard 110/120 AC volt source with no additional equipment or power supplies needed. However, the special attraction offered by the 7201-1 is the thermal bath which is an integral part of the thermoelectric cooling unit. Generously sized, this chamber will hold up to 500 milliliters.

APPLICATIONS

Model 7201-1 is designated for use in applications in which temperature sensitive materials require containment or submerging in a cool bath. It also serves to facilitate the preservation of perishables in the laboratory by providing a constant cold source.

ACCESSORIES

Insulated cover, Model 7206-1, will isolate items being cooled from ambient fluctuations, thus improving the performance of the 7201-1.

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CAMBION®

technical data

Model

7210-1

Variable Control
Laboratory Cold Plate



PERFORMANCE

CAMBION'S Model 7210-1 is a Variac-controlled thermo-electric cold plate engineered to provide below ambient cooling and to maintain a 40 watt (136 BTU/hour) load at ambient temperature. Temperature variation from -10°C to ambient is allowed by an adjustable knob.

FEATURES

In addition to a set point range of -10°C to ambient, Model 7210-1 features plug-in readiness. It operates from a standard 110/120 AC volt source with no additional equipment or power sources necessary. Size of the 7210-1 is conveniently compact; it lends itself to limited space applications and to portability.

APPLICATIONS

CAMBION'S Model 7210-1 has potential in any application-educational, research, bio-medical laboratory, production line testing - that demands that temperatures of laboratory equipment, biologicals, medical specimens, etc., be controlled within the range -10°C to ambient.

ACCESSORIES

Insulated cover, Model 7205-1, is available for the 7210-1. This cover isolates items from all ambient fluctuations and is easily removed when its use is not desired.

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70205

GENERAL CHARACTERISTICS

Model 7210-1 operates from a standard 110/120 AC volt source (60 Hz) and consumes a maximum of 100 watts.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature. It has a load capability of 12 watts at 0°C.

Model 7210-1 has a hand adjustable control. Temperature variation is dependent on ambient temperature fluctuations and load.

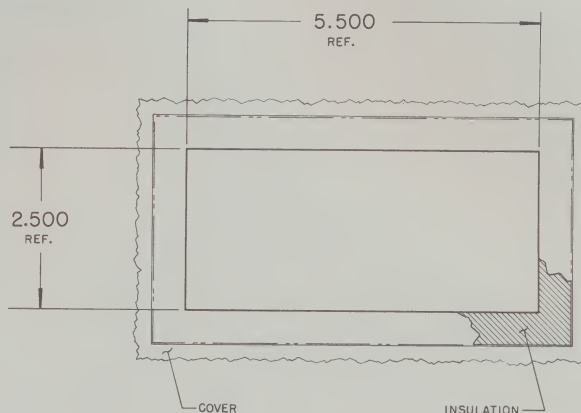
Limitations: Heat sink to cold plate temperature differential 50°C (90°F).

CAMBION'S 7210-1 is a self-contained thermoelectric laboratory cold plate with an internal power supply. The thermoelectrically cooled cold plate with an integral forced convection heat sink and variable control provides a reliable cold source within the range of -10°C to ambient.

Model 7210-1 is housed in a steel box with a wrinkle-paint finish and it has a stainless cover and handles. The handles ease the portability of the instrument, yet fold down when not in use.

This model is invaluable in controlling the temperature of laboratory equipment, biologicals, medical specimens, and components on test.

Top View of a 7210-1 Cold Plate



PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 5 1/2"
Weight: ~17 lbs.

Cooling Surface Area (Cold Plate):
14 square inches. (See top view sketch of cold plate.)

Cord with 3-prong grounded plug
On/off operating switch
Neon indicator lamp
Safety fuse

All components are fully assembled - ready for operation.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

CAMBION®

technical data

Model

7211-1

Variable Temperature
Control Bath



PERFORMANCE

CAMBION'S Model 7211-1 is a variable temperature control bath which is able to maintain a 40 watt load at ambient. Temperature variation from -10°C to ambient is allowed by simply turning a selector knob. Model 7211-1 operates from a standard 110/120 AC volt source with no additional equipment or power sources necessary.

FEATURES

Of special interest in the 7211-1 is the cooling chamber which is an integral part of the thermoelectric cold plate. The chamber measures $6\frac{1}{2}'' \times 3\frac{1}{4}'' \times 2''$ * and will hold a maximum of 500 milliliters.

APPLICATIONS

Applications for Model 7211-1 include: the temperature control of small liquid baths; a reference source for gas traps; a cooling chamber for biological specimens; the pre-chilling of specimens used for fluorescence photometry; the temperature control of two-part resin epoxy systems.

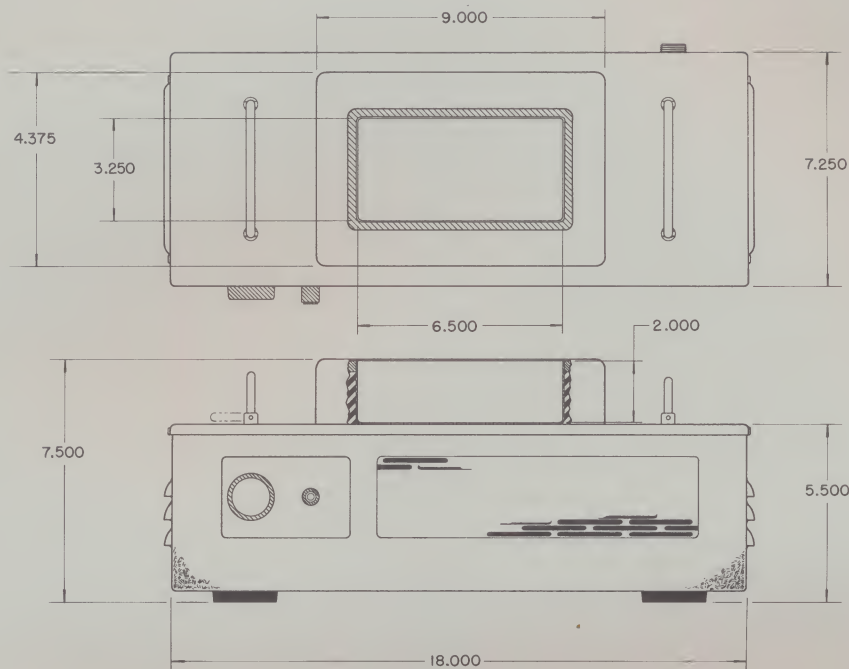
ACCESSORIES

Insulated cover Model 7206-1 is available for the 7211-1. This cover serves to isolate materials being cooled from all ambient fluctuations

*Customized chamber configurations may be ordered at additional cost.

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Top and Side View of a 7211-1



GENERAL CHARACTERISTICS

Model 7211-1 operates from a standard 110/120 AC volt source (60 Hz) and consumes a maximum of 100 AC watts.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature. It has a load capability of 12 watts at 0°C.

Limitations: Heat sink to cold plate temperature differential 50°C (90°F).

Model 7211-1 is completely assembled and ready for immediate operation. The chamber is ideal for use in applications in which temperature sensitive materials require containment or submerging in a controlled bath.

PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 7 1/2"
Weight: ~17 lbs.

Chamber Dimensions:
6 1/2" x 3 1/4" x 2"

Housed in a steel box with wrinkle paint finish, Model 7211-1 is equipped with stainless handles to ease portability. Self-contained, CAMBION'S Model 7211-1 with variable control, provides a reliable thermal source within the range -10°C to ambient.

For additional information consult the thermoelectric engineering staff at CAMBION.

CAMBION®

technical data

Model

7212-1

Automatically Controlled
Laboratory Cold Plate



PERFORMANCE

Model 7212-1 is an automatic rather than variable controlled thermoelectric cold plate* geared for utilization in scientific research. It is capable of maintaining a 40 watt load at ambient temperature. Temperature adjustments between -10°C and ambient are made by means of a selector knob.

FEATURES

The 7212-1 is sold fully assembled and ready for operation. It operates from a standard 110/120 AC volt source with no additional power supplies or other equipment necessary. Not only is it self-contained, but it is portable as well. Total weight is approximately 18 pounds - easily lifted by means of two stainless handles mounted on the stainless cover.

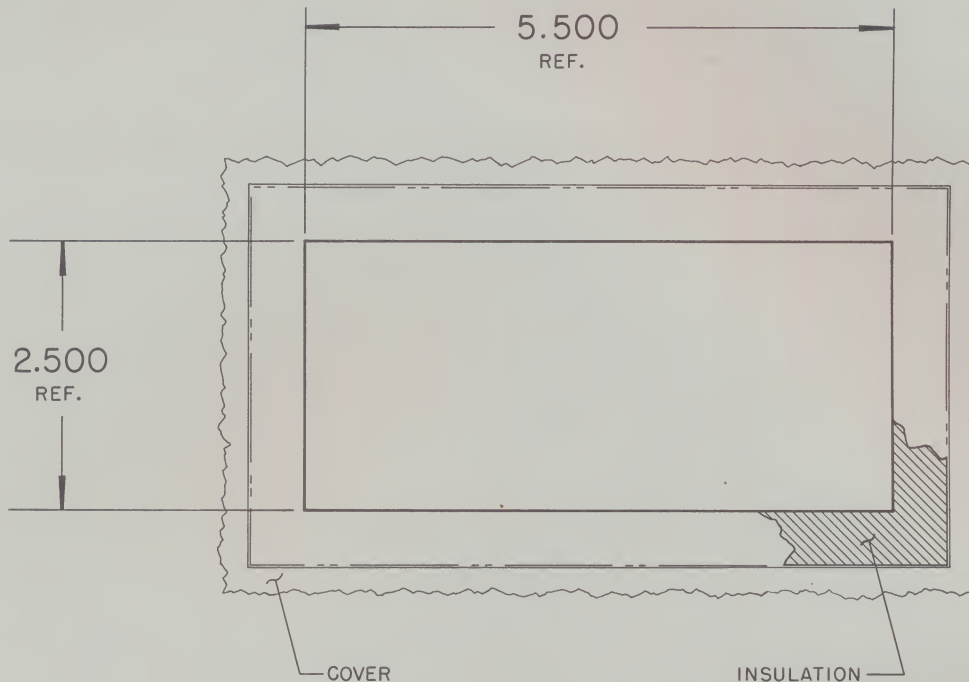
APPLICATIONS

Model 7212-1 is an excellent choice for production line testing of electronic components and other items demanding temperature controlled test conditions. It is also ideal for controlling the temperature of biological specimens and solutions. In addition, it takes a leading role in the temperature control of two-part resin epoxy systems.

*Customized cold plates may be ordered at additional cost.

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Top View of a 7212-1 Cold Plate



GENERAL CHARACTERISTICS

Model 7212-1 operates from a standard 110/120 AC volt source (60 Hz), and consumes a maximum of 100 AC watts.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature. It has a load capability of 12 watts at 0 °C.

Limitations: Heat sink to cold plate temperature differential 50 °C (90 °F).

CAMBION'S 7212-1 is a self-contained thermoelectric cold plate with an internal power supply. The automatically controlled thermoelectric cold plate provides a reliable thermal source within its range -10 °C to ambient.

Each unit is subjected to several phases of testing throughout assembly including a specific calibration test in order to supply a set point calibration curve with each assembly.

PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 5 1/2"
Weight: ~17 lbs.

Cold Plate Surface Area: 14 square inches.

Model 7212-1 is ruggedly constructed. Its outer shell is steel with a handsome wrinkle-paint finish. The lid and handles are both stainless - functional and attractive.

For additional information concerning characteristics and/or applications in specific systems, consult the thermoelectric engineering staff at CAMBION.

CAMBION® technical data

Model

7213-1

Automatic Temperature
Control Bath



PERFORMANCE

CAMBION'S Model 7213-1 is an automatic temperature control bath which is well suited for utilization in many aspects of scientific research by nature of the range it offers: -10°C to ambient. This unit is capable of maintaining a 40 watt load at ambient temperature. Temperature adjustments are made easily by means of a selector knob.

FEATURES

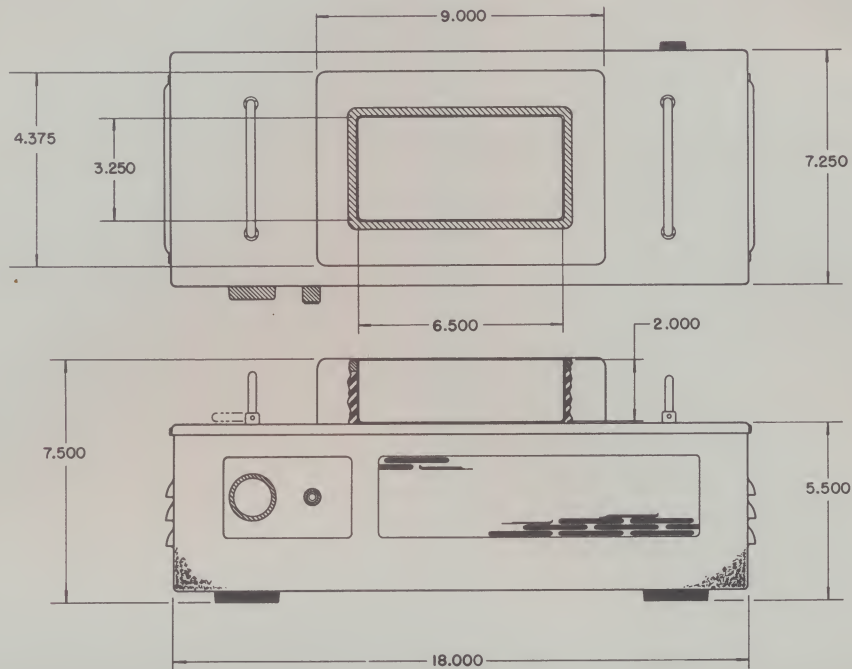
First of several features built into Model 7213-1 is the proportionally controlled thermal chamber. The temperature of the material to be regulated is picked up by an externally located sensor and relayed to the internal circuitry which automatically regulates the performance of the thermoelectric devices. The chamber measures $6\frac{1}{2}'' \times 3\frac{1}{4}'' \times 2''$ and has the capacity to hold up to 500 milliliters. It is ideal for use in applications in which the material to be thermally controlled requires containment or submerging in a regulated fluid bath.

APPLICATIONS

Model 7213-1 offers potential for many applications including the temperature control of small liquid baths, a reference source for gas traps, a cooling chamber for biological specimens, the pre-chilling of specimens used for fleurospectrophotometry, the temperature control of two part resin epoxy systems, and a wide variety of additional applications.

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Top and Side Views of 7213-1 with Chamber



GENERAL CHARACTERISTICS

Model 7213-1 operates from a standard 110/120 AC volt source (60 Hz), and consumes a maximum of 100 AC watts.

Model 7213-1 has an automatic temperature control. Temperature variation is independent of ambient temperature fluctuations and load.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature. It has a load capability of 12 watts at 0°C.

Limitations: Heat sink to cold plate temperature differential 50°C (90°F).

Model 7213-1 is completely assembled and ready for plug-in operation. Each unit is performance tested before shipment and a set point calibration curve is included with each assembly.

PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 7 1/2"
Weight: ~17 lbs.

Chamber Dimensions: 6 1/2 x 3 1/4 x 2"
Capacity: 50 milliliters

Housed in a steel box with wrinkle paint finish, Model 7213-1 is equipped with stainless handles to ease portability. Self-contained, CAMBION'S Model 7213-1 with automatic control provides a reliable thermal source within its range -10°C to ambient.

For additional information concerning specific design requirements, consult the thermoelectric engineering staff at CAMBION.

CAMBION®

technical data

Models

7220-1 through 7220-4

Thermoelectric

Laboratory Cold Plate

Automatically Controlled



PERFORMANCE

Intended for scientific and educational use for the temperature stabilization of components and biological specimens. All are proportionally controlled cold or warm plates designed to control temperature above or below ambient.

FEATURES

The series offers set point ranges of -10°C to 60°C which allow desired set point temperatures to be dialed in and held without further adjustment and will hold set temperatures within $\pm 2^{\circ}\text{C}$ under varying ambient and load conditions. They have a maximum heat pumping capacity of 40 watts or 136 BTU's/hour, with the set point at ambient.

APPLICATIONS

The 7220-1 series is ideal for medical and biological laboratory applications where set point temperatures of $+4^{\circ}\text{C}$, $+20^{\circ}\text{C}$, and $+37^{\circ}\text{C}$ are required. It is also ideal for test laboratories for maintaining critical temperature levels on components under test.

ACCESSORIES

Insulated cover, Model 7205-1, is available for the 7220-1. This cover isolates items being cooled or heated from all ambient fluctuations.

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GENERAL CHARACTERISTICS

Models 7220-1 through 7220-4 operate from a standard 110/120 AC volt source (60 Hz), and consume a maximum of 100 AC watts.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature. They have a load capability of 12 watts at 0°C.

Limitations: Heat sink to cold plate temperature differential 50°C (90°F).

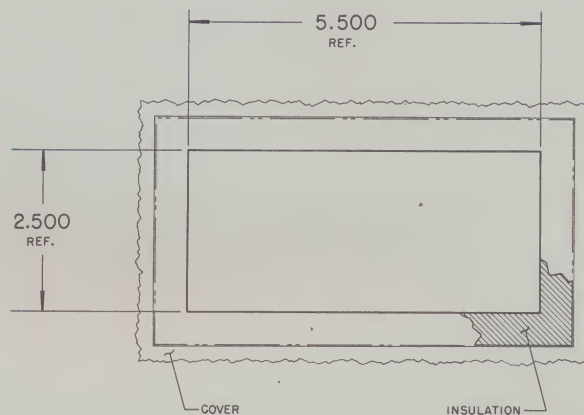
The 7220 series features an automatic temperature control. The selected temperature is maintained independently of ambient temperature fluctuations and load.

Each Model is self-contained with an internal power supply and integral forced convection heat sink. The automatic control provides a reliable cold source within the following ranges:

7220-1	0°C to 40°C
7220-2	0°C to 60°C
7220-3	-10°C to 40°C
7220-4	-10°C to 60°C

Each unit is subjected to several phases of testing throughout assembly including a specific calibration test in order to supply a calibration curve with each assembly.

Top View of the 7220-1 through 7220-4 Cold Plates



PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 5 1/2"
Weight: ~17 lbs.

Cold Plate Surface Area: 14 square inches (see sketch).

Housed in steel boxes with wrinkle paint finish, all instruments in this series are equipped with stainless handles to aid portability. In addition, each unit is completely assembled and is ready for immediate operation.

For additional information, consult the thermoelectric engineering staff at CAMBION.

CAMBION®

technical data

Models

7221-1 through 7221-4

Automatic Temperature
Control Bath



PERFORMANCE

CAMBION'S new 7221 family offers the same operating characteristics and criteria as the 7220-1 series. The instruments in this group operate from a standard 110/120 AC volt source. Each is completely assembled - ready for plug-in use.

FEATURES

The 7221 series offers set point ranges between -10°C and 60°C which may be dialed in and automatically held within $\pm 2^{\circ}\text{C}$ under varying ambient and load conditions. Maximum heat pumping capacity is 40 watts (136 BTU's/hour) with the set point at ambient. Another important feature is the automatically controlled thermal chamber. The temperature of the load is picked up by an externally located sensor and is relayed to the internal circuitry which automatically adjusts the temperature to the temperature dialed in. The chamber measures $6\frac{1}{2}'' \times 3\frac{1}{4}'' \times 2''$ and has the capacity to hold up to 500 milliliters.

APPLICATIONS

This series is ideal for the temperature control of small liquid baths; a cooling chamber for biological specimens; for controlling the temperature of printing inks to maintain viscosity; for cooling critical components in circuits, and a wide variety of additional applications.

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GENERAL CHARACTERISTICS

Models 7221-1 through 7221-4 operate from a standard 110/120 AC volt source (60 Hz) and consume a maximum of 100 AC watts.

Heat pumping capacity: 40 watts or 136 BTU's/hour maintained at ambient temperature. They have a load capability of 12 watts at 0°C.

Limitations: Heat sink to cold plate temperature differential 50°C (90°F).

The 7221 series features an automatic temperature controller. The selected temperature is maintained independently of ambient temperature fluctuations by means of a sensor which may be attached directly to the load.

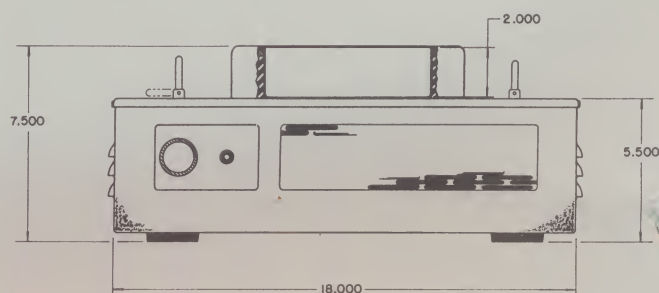
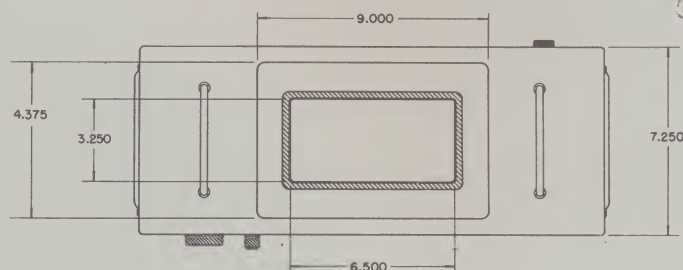
Each model is self-contained with an internal power supply and integral forced convection heat sink. The automatic control provides a reliable cold source within the following ranges:

7221-1	0°C to 40°C
7221-2	0°C to 60°C
7221-3	-10°C to 40°C
7221-4	-10°C to 60°C

Each unit is subjected to several phases of testing throughout assembly including a specific calibration test in order to supply a specific set point calibration curve with each assembly.

For additional information concerning specific design requirements, consult the thermoelectric engineering staff at CAMBION.

Top and Side Views of the 7221-1 through 7221-4 with Chamber



PHYSICAL CHARACTERISTICS

Length: 18"
Width: 7 1/4"
Height: 7 1/2"
Weight: ~17 lbs.

Chamber Dimensions: 6 1/2 x 3 1/4 x
Capacity: 500 milliliters

CAMBION® latest developments

Models

7222-1 through 7222-4

Water Cooled, Automatic
Temperature Bath



PERFORMANCE

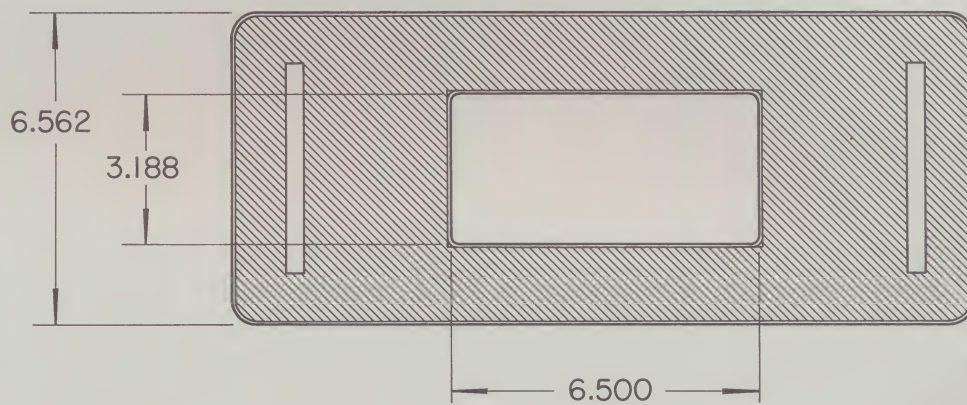
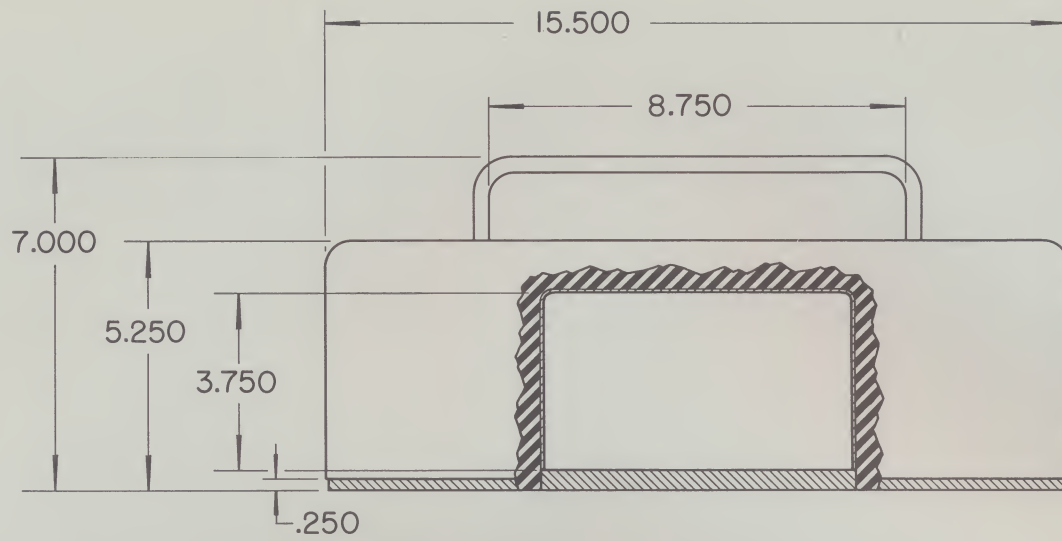
CAMBION'S new 7222 series are automatic temperature control baths capable of maintaining a 50 watt load at ambient temperature; 15 watts at 0°C. Temperature adjustments are made easily by means of a selector knob and a set point calibration curve.

FEATURES

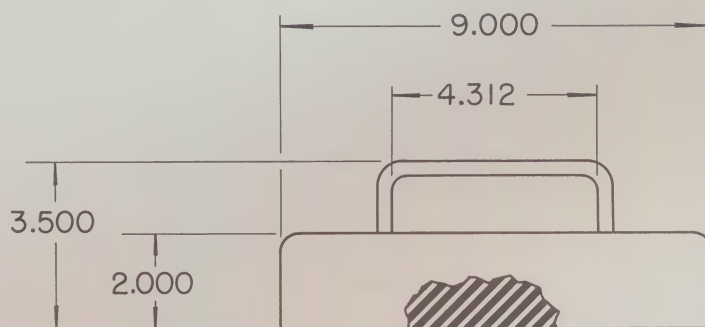
A unique innovation in CAMBION'S instrumentation line is the use of water to dissipate the heat generated by the thermoelectric components. With this method, set point ranges varying from -20°C to +60°C are available. Another feature is provided by the recessed thermal chamber. This chamber has the capacity to hold up to 1400 milliliters. The temperature of the load to be regulated is picked up by a sensor, which may be applied directly to the load, and is relayed to the internal circuitry which automatically regulates performance of the thermoelectric devices.

APPLICATIONS

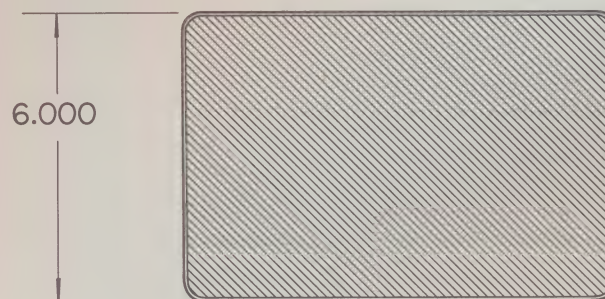
The instruments in this group are ideal for medical and biological laboratory applications where set point temperatures of 0°C, 4°C, 20°C, and 37°C are required, and they offer potential for the temperature control of liquid baths, as a reference source for gas traps, and for a wide variety of additional applications.



7205-1 Insulated Cover



7206-1 Insulated Cover



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CAMBION ELECTRONIC PRODUCTS, LTD.

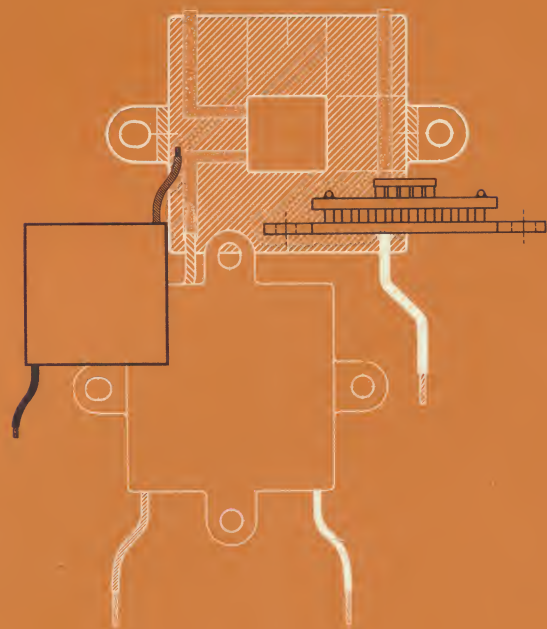
Castleton, Near Sheffield, England

Telephone Hope 406/407
TELEX 54444

SAMBION

THERMOELECTRICS

... components



application note

No.: AN 1-67

INSTALLING CAMBION THERMOELECTRIC DEVICES

Mounting and Locating Considerations

After you choose the thermoelectric device or devices to meet heat pumping requirements, temperature requirements and electrical requirements for an application, mechanical limitations must be considered. TED's are only as strong as the semiconductor materials used in fabrication. These materials are arranged in multiple-junction series configurations consisting of N-type and P-type Bismuth Telluride alloy (N-type: $\text{Bi}_2\text{Te}_3 - \text{Bi}_2\text{Se}_3$; P-type: $\text{Bi}_2\text{Te}_3 - \text{Sb}_2\text{Te}_3$). These quaternary alloys exhibit strong cleavage characteristics with resulting low mechanical strength. Chemically bonded to both ends of the N and P elements are nickel interface barriers. These interface barriers prevent impurity diffusion (with resulting performance degradation) from the solder-copper interface to the Bismuth Telluride elements. The nickel interface barriers between the solder and Bismuth Telluride can be damaged by undue mechanical stress.

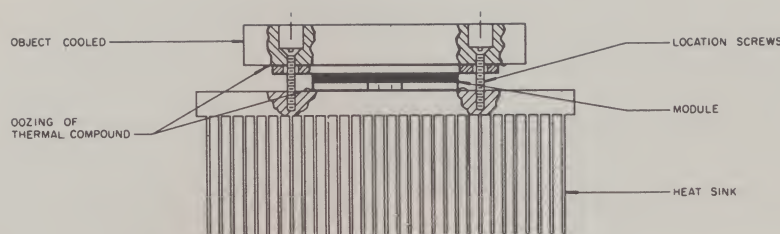
To insure proper performance of low current, high voltage CAMBION TED's proper mechanical design considerations must be followed:

- (1) CAMBION TED's are held to flatness and parallelism tolerances of $+.005'' - .000''$ of specified thickness.
- (2) Mounting surfaces in contact with TED's should be held to a flatness tolerance of $.002''$ TIR.
- (3) A good thermal interface compound should be used on hot and cold interfaces.
 - (a) Zinc oxide loaded silicon grease (i. e. , Wakefield Engineering - Thermal Joint Compound Type, #120 G. E. - Insulgrease(R) #G641 or equivalents).

- (b) Thermally conductive metal loaded epoxies can be used without hardener (i. e. , silver, copper or aluminum loaded).
 - (c) Where permanent bonding of the TED hot junction to a heat sink is required, thermally conductive epoxies can be used (i. e. , Wakefield Engineering - Delta Bond - 152).
- (4) A TED should not be designed as a mechanical supporting member of an assembly.
- (5) To avoid using a TED as a mechanical supporting member, we recommend the TED be "sandwiched" in a compression bond between the heat sink and object being cooled.
- (a) Nylon screws can be utilized where constant heat sink and cold plate temperatures are anticipated.
 - (b) If the thermoelectric assembly is to be temperature cycled, we recommend that 6-32 or 8-32 steel screws be used in conjunction with a steel spring type lock washer to allow for differential thermal expansion.

As a guide to proper application, the following step-by-step procedures are recommended (see Figure 4).

- (1) Remove all burrs, grit and foreign particles from vicinity.
- (2) Coat hot side of module with even layer of thermal joint compound.
- (3) Place hot side of module at desired location on heat sink.
- (4) Using firm but even pressure, slide module about desired location until resistance is felt and uniform oozing of interface compound is observed around module.
- (5) Coat cold side of module with even layer of thermal joint compound.
- (6) Place object to be cooled in approximate position on module.
- (7) Repeat Step 4, slide object instead of module and be particularly careful to maintain even pressure.
- (8) Tighten location screws finger tight.



Heat Sink Considerations

An important and often critical factor in the application of TED's is the heat sink performance required to meet specified temperature differential and heat pumping criteria. The importance of T_s for the effective application of TED's cannot be overemphasized.

All performance characteristics for TED's will vary as a function of the T_s value. It therefore follows that design criteria must be established on the basis of maximum anticipated T_s values. For optimum TED performance, the order of desirability of the three major methods of heat dissipation is: (1) liquid cooling, (2) forced convection, (3) natural convection. For each of the above methods of dissipation, the T_s value will rise above the ambient temperature value T_a as a function of total power dissipated Q_s times the effective thermal resistance of the heat sink Θ_s . The following thermal resistance value ranges can be obtained with available standard or special heat sinks. For liquid cooling (i. e., water), $\Theta_s = .03^\circ\text{C}/\text{watt}$ to $.05^\circ\text{C}/\text{watt}$; for forced convection systems, $\Theta_s = .07^\circ\text{C}/\text{watt}$ to $.5^\circ\text{C}/\text{watt}$; and for natural convection systems, $\Theta_s = .6^\circ\text{C}/\text{watt}$ to $5.0^\circ\text{C}/\text{watt}$. We strongly recommend the use of liquid exchange or forced convection heat exchangers for high power dissipation thermoelectric applications. The following values can be used as a guide in determining T_s rise above coolant temperature T_Θ as a function of effective thermal resistance Θ_s for liquid exchangers and forced convection exchangers. For a liquid exchange system at a power dissipation level of 100 watts, use a maximum T_s rise of 5°C above liquid coolant temperature T_Θ . For a forced convection exchange system at a power dissipation level

of 100 watts, use 15°C rise above the ambient temperature $T_{\Theta} = T_a$. These values are intended to be conservative in order to allow a margin of performance safety. Special heat exchange systems can be designed to provide smaller temperature rises under the same conditions.

Power Supply and Temperature Control Considerations

Power supply considerations for most thermoelectric applications are relatively straightforward. A non-regulated fixed output DC power supply can often be used. Standard CAMBION fixed output power supplies are full wave, half bridge rectification circuits with a filter choke in series with the output. The size of the filter choke is dependent on the acceptable level of AC ripple allowable for TED operation before performance degradation occurs. A 10% AC ripple level has become the industry standard. However, based on CAMBION test data and published information ⁽¹⁾ on the effect of percentage variation of AC ripple on performance, a much higher percentage of AC ripple is usually acceptable. We recommend an AC ripple level limit of 15% to 20% for most applications and as high as 30% for certain specialized applications.

The required power necessary for CAMBION TED's is frequently available within systems where the TED's are to be used.

Temperature control requirements for some applications are straightforward and for others complicated. For certain sensitive components, no temperature control is required as long as the design parameters prevent the components from rising above the critical temperature requirement. On/off thermostats can be utilized where tolerance levels of $\pm 1^{\circ}\text{C}$ to $\pm 5^{\circ}\text{C}$ are required. For more precise temperature control, proportional control networks can be used. Systems incorporating CAMBION TED's with temperature control of $\pm .001^{\circ}\text{C}$ have been in operation since November of 1963. For specific requirements, please consult the factory.

⁽¹⁾H. Trantham, Jr., Instrumentation Laboratory, Massachusetts Institute of Technology - Report E-1537, March (1964)

Test Procedures

When evaluating thermoelectric device performance, it is necessary to know the test procedures utilized to obtain TED data, and most important the conditions under which the devices were tested. In view of the importance of the T_s value in determining whether design criteria can or cannot be met, all CAMBION TED's are tested over a wide T_s range. Performance characteristics for standard TED's over a T_s range of 0°C to +50°C are available from the factory. Performance characteristics for standard CAMBION TED's are measured under the following easily reproduced conditions: (1) atmospheric pressure, (2) light insulation on T_c surface to prevent rapid condensation and freezing of moisture during test, (3) still air, and (4) normal ambient temperatures.

Temperature differential measurements are determined from T_s to T_c in centigrade degrees. Interface losses between the hot junction and the heat sink are included in the published values. Heat pumping characteristics are determined under the same conditions using a resistor block thermally mounted to the cold plate. Calibrated laboratory equipment is utilized for all tests. Calibrations are traceable to the National Bureau of Standards. CAMBION has available a unique customer incoming inspection procedure for all standard modules based on statistical data compiled from a 100% test program for thousands of standard modules.

Facility evaluation and source inspection for military and space applications of special units are available.

CAMBION TED's have been subjected to Mil-Spec and NASA test conditions over a wide range of frequency, vibration, shock and atmospheric conditions.

CAMBION Thermoelectric Modules were the FIRST selected for manned orbital space flight.

For additional information pertaining to test conditions, quality control procedures and special Mil-Spec and NASA test requirements, please contact the factory directly.

Gordon S. Bird, Jr., Product Manager
Thermoelectric Department

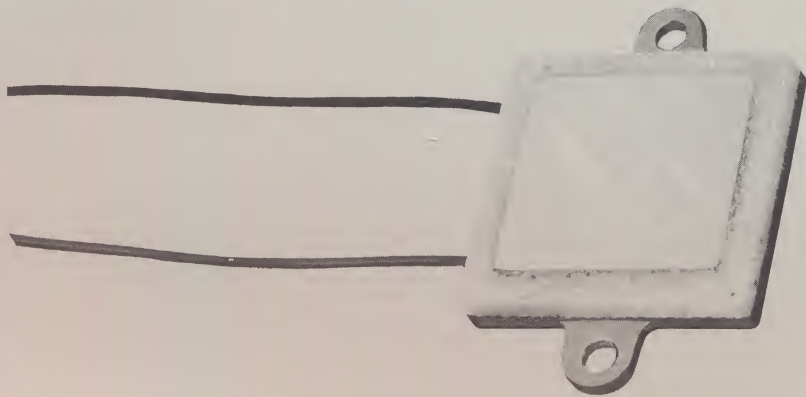
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February 1967

CAMBION technical data

Model
3950-1

6.8 Watt Capacity,
6.5 Ampere
Thermoelectric Component



PERFORMANCE

CAMBION'S Model 3950-1 is a low current, high heat pumping capacity thermoelectric device. By employing advanced state-of-the-art techniques, Model 3950-1 is able to yield a high heat pumping capacity of approximately 6.8 watts at a temperature differential of 0°C . With the heat sink temperature (T_s) at 27°C , a temperature differential of 54°C may be attained by this device.

FEATURES

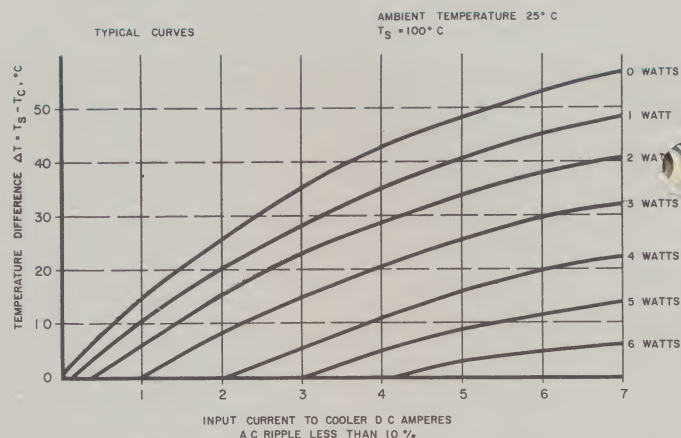
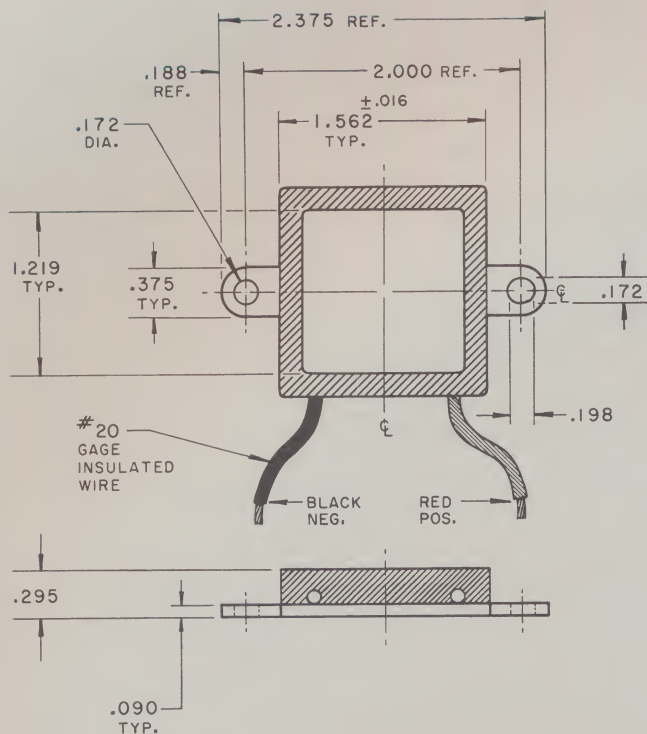
Built-in compactness and reliability are characteristic features of Model 3950-1. It has been specifically designed to make incorporation into a system easy to engineer by nature of its low current requirements and modest cost.

APPLICATIONS

Model 3950-1 performs well as a spot cooler for heat sensitive SCR's and oscillator crystal holders; as a temperature stabilizer for integrated circuit strips during tests; as a temperature controller for sensitive components in fluctuating ambients; and as a temperature controller in numerous applications.

ACCESSORIES

Fixed output power supply, Model 3973-1 is suggested for use with Model 3950-1.



GENERAL CHARACTERISTICS

6.5 dc amperes

2.6 dc volts

$Q_c = 6.8$ watts at $0^\circ\text{C } \Delta T$, or
 $45^\circ\text{C } \Delta T_{\min.}$ *, atmospheric
 pressure, $T_s = 27^\circ\text{C}$.

* ΔT is the temperature differential between the heat sink (T_s) and the cold plate (T_c), assuming interface losses, expressed by the equation:

$$\Delta T = T_s - T_c.$$

$\Delta T_{\min.}$ as used above, describes minimum temperature differential obtained under no heat load conditions at prescribed current input. Data was taken in still air, at atmospheric pressure, with light insulation on the cold plate.

Some application requirements are:

AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

For optimum performance, mount the 3950-1 directly to a low thermal resistance heat sink. Forced convection heat sink systems with a thermal resistance of 0.1° to 0.3°C/watt are recommended.

For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

CAMBION®

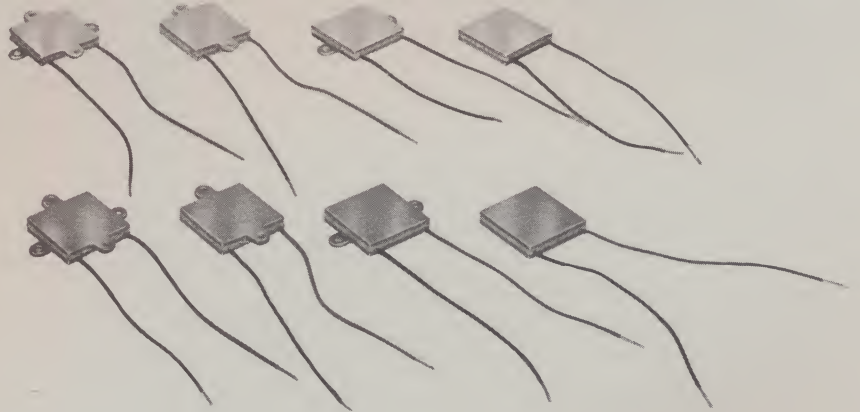
technical data

Models

3951-2 through 3951-16

CAMBION'S (R) NEW

3951 LINE



PERFORMANCE

CAMBION'S new 3951 family offers the same operating characteristics and criteria as the 3951-1. The TED's* in this group operate at an optimum current of 7 dc amperes at 6.4 dc volts giving a heat pumping capacity of 20 watts (68 BTU's/hour).

FEATURES

Highlights of the 3951 line focus on physical modifications which allow maximum flexibility in meeting design specifications. For example, units may be ordered with either aluminum or copper hot and cold plates and with any combination of mounting tabs desired: with all four, with two on the top, with two on the bottom, or NONE AT ALL! In addition, modules may be purchased without the usual foam insulation and without surface machining at a price reduction.

Above all, these units, formerly available as special orders only, may now be ordered as standard parts to be shipped directly from stock.

ACCESSORIES

CAMBION Model 3972-1, standard power supply for the 3951 family is available from stock, while staked aluminum, forced convection heat sinks may be obtained by special order.

*Thermoelectric Devices

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Model	A*	B*	C*	D*	Fig.
3951-1	Al	4	T, B	X	1
3951-2	Al	2	B	X	2
3951-3	Al	2	T	X	3
3951-4	Al	-	-	X	4
3951-5	Al	4	T, B	-	1
3951-6	Al	2	B	-	2
3951-7	Al	2	T	-	3
3951-8	Al	-	-	-	4
3951-9	Cu	4	T, B	X	1
3951-10	Cu	2	B	X	2
3951-11	Cu	2	T	X	3
3951-12	Cu	-	-	X	4
3951-13	Cu	4	T, B	-	1
3951-14	Cu	2	B	-	2
3951-15	Cu	2	T	-	3
3951-16	Cu	-	-	-	4

*A Plate material (Aluminum or Copper Cu)

*B	<u>Number of mounting tabs</u>
----	--------------------------------

*B Number of mounting tabs
*C Position of tabs (Top or Bottom plate)

*D Foam insulation, Surface milling

GENERAL CHARACTERISTICS

6.5 dc amperes at 100% I optimum

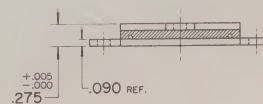
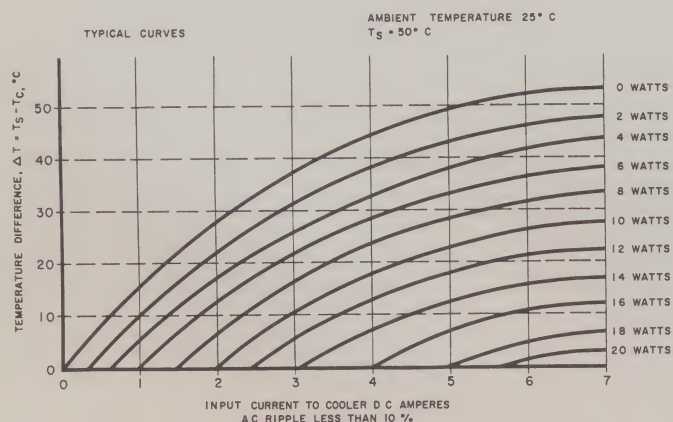
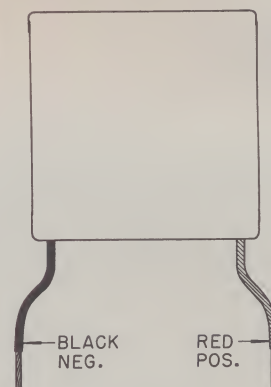
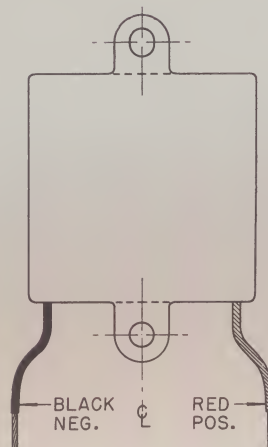
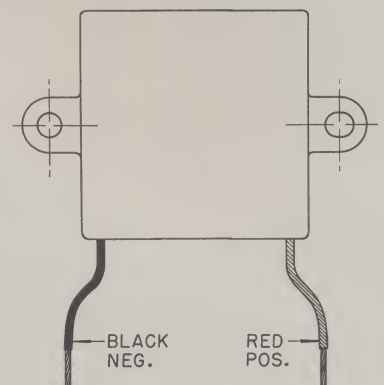
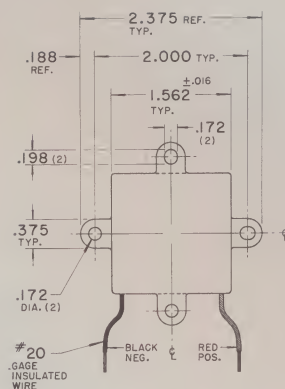
5.7 dc volts at $T_g = 50^\circ\text{C}$

20 watts (68 BTU^s/hour) heat pumping capacity at $T_s = 50^\circ\text{C}$

AC Ripple required: 10% - 15%

Maximum allowable hot junction temperature: $\pm 125^{\circ}\text{C}$

Forced convection heat sink systems with a thermal resistance of 0.1° to 0.3°C/watt are recommended.



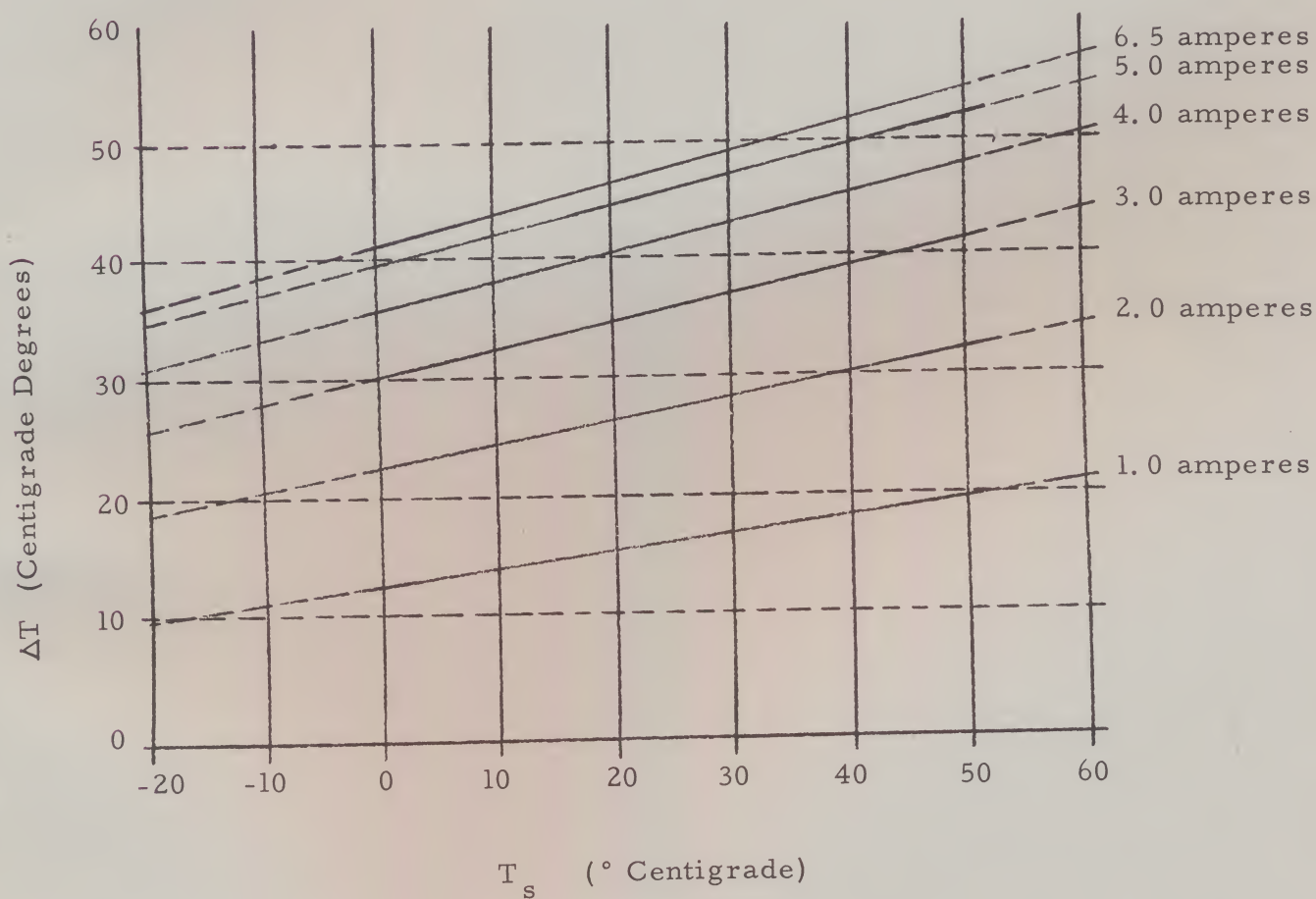
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technical data

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OPERATING CHARACTERISTICS

CAMBION MODEL 3951-1



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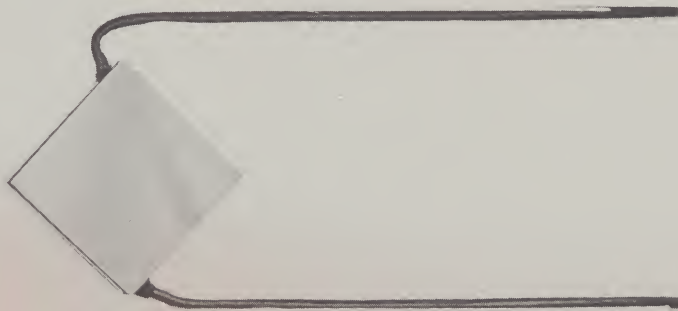
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CAMBION[®] latest developments

Model
3952-1

1500 Milliampere
Thermoelectric Component



PERFORMANCE

Model 3952-1 employs CAMBION'S thermoelectric manufacturing techniques to good advantage. This module is permanently mounted between two aluminum plates to insure mechanical strength and uniformity of cold junction temperatures. The aluminum plates are electrically and thermally isolated. The 3952-1 operates at an optimum current of 1500 milliamperes and offers a heat pumping capacity of 2000 milliwatts or 6.8 BTU's/hour.

FEATURES

Small size and low current requirements are attributes of Model 3952-1. These features make it possible to connect the device directly to most systems where DC power is available within the circuit. In such cases, the 3952-1 will operate without the need of an additional power supply and will provide reliable uniform cold junction temperatures.

APPLICATIONS

An answer to "hot spot" and thermal control problems is supplied by Model 3952-1. A major application for this module is temperature control for miniature component ovens and oscillator crystals. Another possible application is temperature control of heat sensitive SCR's.

ACCESSORIES

Fixed output power supply, Model 3974-1, is suggested.

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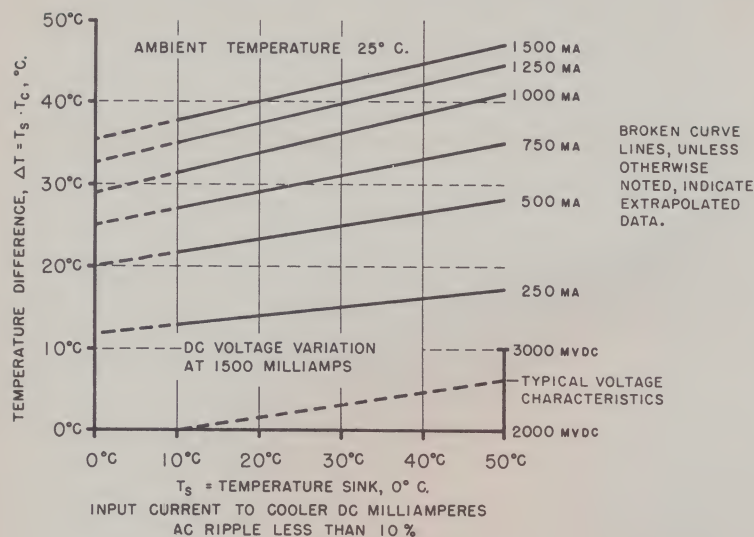
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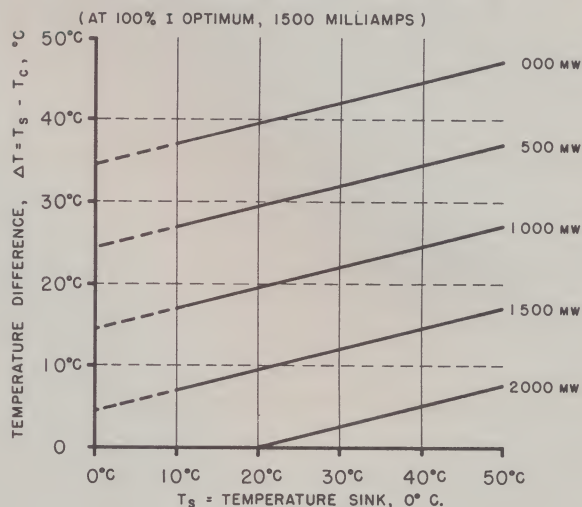
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TYPICAL TEMPERATURE DIFFERENTIAL CURVES



TYPICAL HEAT PUMPING CHARACTERISTICS



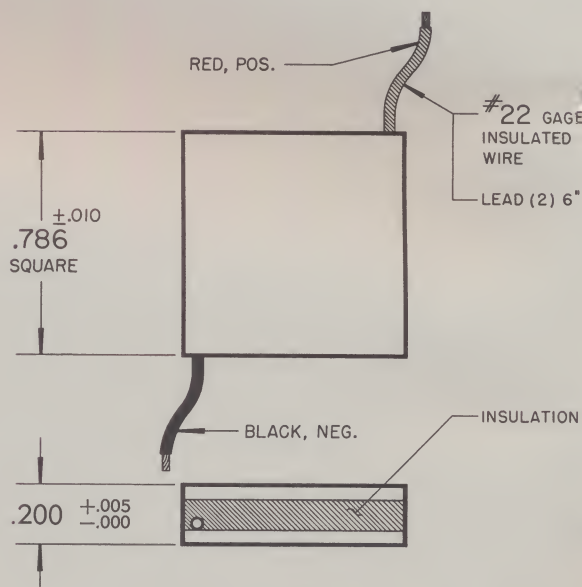
GENERAL CHARACTERISTICS

- 1.5 dc amperes at 100% I optimum
- 2.3 dc volts at T_s = 27°C
- 2 watts (6.8 BTU's/hour) =
heat pumping capacity at T_s = 27°C

Size: 2cm x 2cm x .5cm

3952-1 is used to best advantage when mounted directly to a low thermal resistance heat sink. Forced convection heat sink systems with a thermal resistance of 0.1° to 0.3°C/watt are recommended. Also advised is the use of liquid cooled (e.g., water) heat sinks where applicable.

Some application requirements are:
AC ripple (10-15%); maximum allowable hot junction temperature (T_s = 125°C); dielectric strength (top plate to bottom plate minimum 250 volts).



For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

CAMBION technical data

Models

3953-1 through 3953-4

Thermoelectric Annular Rings



PERFORMANCE

Models 3953-1, -2, and -3 offer the same operating characteristics and criteria. These devices operate at an optimum current of 6.5 dc amperes with a heat pumping capacity of 20 watts (68 BTU's/hr), at $T_s = 27^\circ\text{C}$. The exception is Model 3953-4 which operates at 6.5 dc amperes, but with a heat pumping capacity of 14 watts as a result of its modified circuit configuration.

FEATURES

Physical configuration is the prime feature of this group. The annular ring concept allows ultimate flexibility in meeting special design specifications. With these devices, items to be cooled may either be mounted directly to the cold plate, or may be inserted through the ring. In addition, the round shape of this component line offers design engineers an option over the conventional square configuration in developing new systems.

APPLICATIONS

These annular rings provide a unique means for cooling heat sensitive SCR's; for freezing silicon chips to facilitate dicing operations; for cooling Vidicon tubes; and for controlling the temperature of liquids or gases piped through copper tubing in vacuum lines.

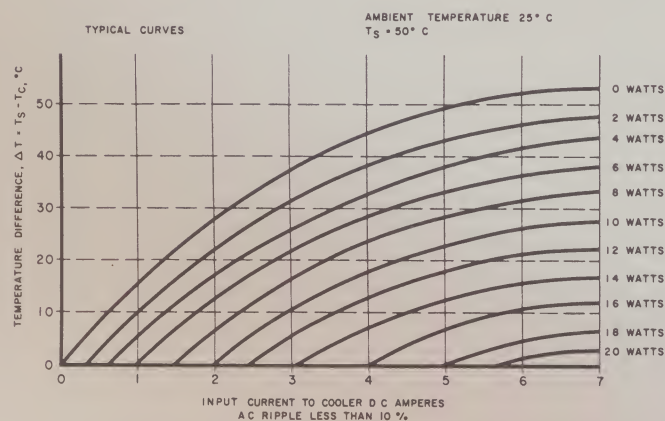
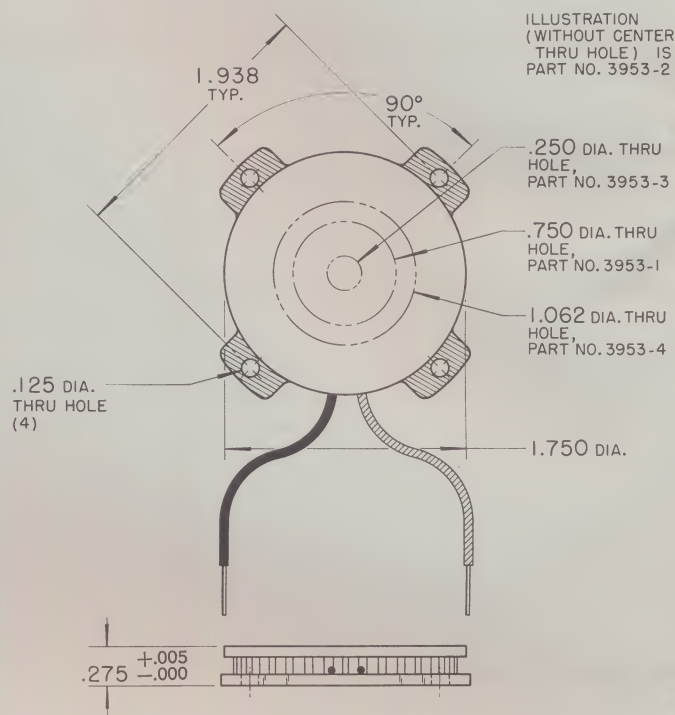
GENERAL CHARACTERISTICS

3953-1	6.5 dc amperes
3953-2	5.7 dc volts
3953-3	$Q_C = 20$ watts (68 BTU's/hr) at $T_s = 27^\circ\text{C}$

3953-4	6.5 dc amperes
	4.02 dc volts
	$Q_C = 14.09$ watts (47.91 BTU's/hr) at $T_s = 27^\circ\text{C}$

Some application requirements are:
AC ripple (10-15%); maximum allowable hot junction temperature ($T_s = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

For optimum performance, mount the 3953's directly to a low thermal resistance heat sink. Forced convection heat sink systems with a thermal resistance of 0.1° to $0.3^\circ\text{C}/\text{watt}$ are recommended.



For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

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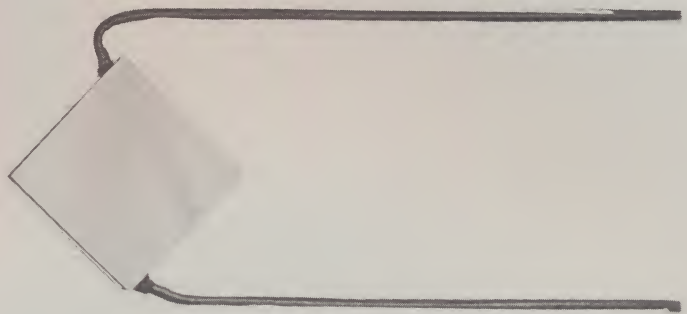
technical data

Model

3954-1

CAMBION'S (R)

9 Watt Capacity,
6.5 dc ampere
THERMOELECTRIC
MODULE



PERFORMANCE

All of CAMBION'S proven design advantages for thermoelectric modules are incorporated in Model 3954-1. This module is permanently mounted between two aluminum plates to insure mechanical strength and uniformity of cold junction temperatures. The aluminum plates are electrically and thermally isolated. The 3954-1 has an optimum current of 6.5 dc amperes at 2.3 dc volts. Although small in size, the 3954-1 offers a heat pumping capacity of 9 watts or 30.6 BTU's/hour.

FEATURES

Model 3954-1 boasts of high capacity over a relatively small cooling surface: 9 watts pumping capacity over 4 square centimeters. Because of this characteristic, it is adaptable to a score of applications. Like all CAMBION thermoelectrics, the 3954-1 is individually tested both during and after assembly to assure that performance standards are upheld.

APPLICATIONS

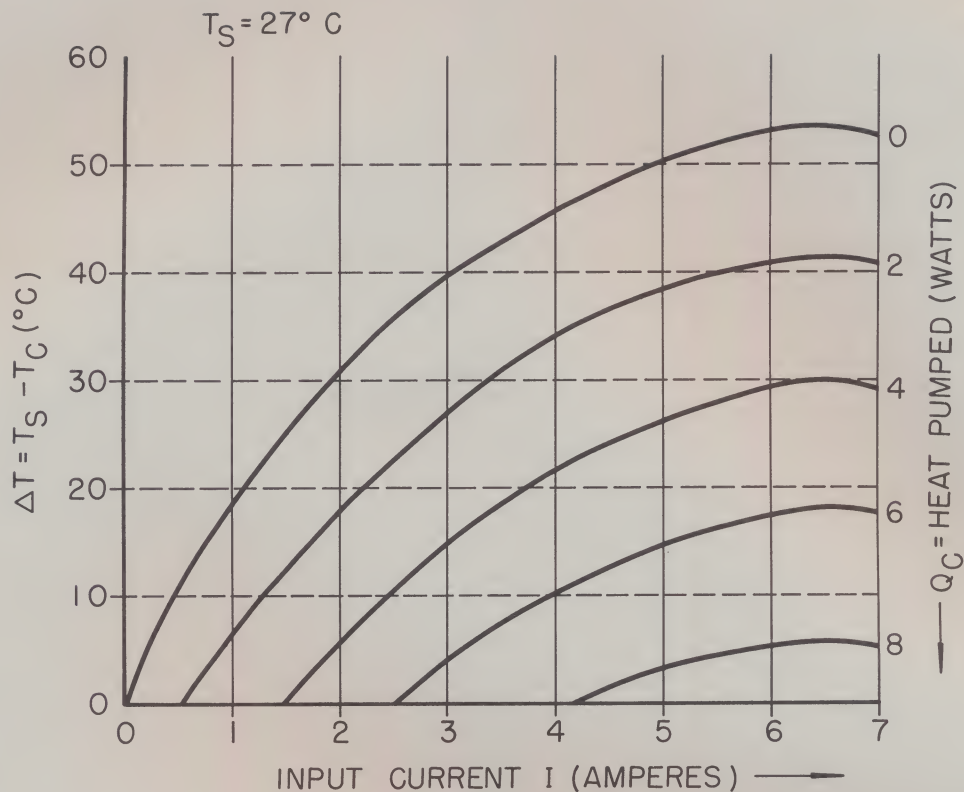
This high capacity package is ideal for such applications as spot cooling of small electronic components, oscillator crystal holders, infrared detectors, and for the temperature control of chemicals and of biological and laboratory specimens.

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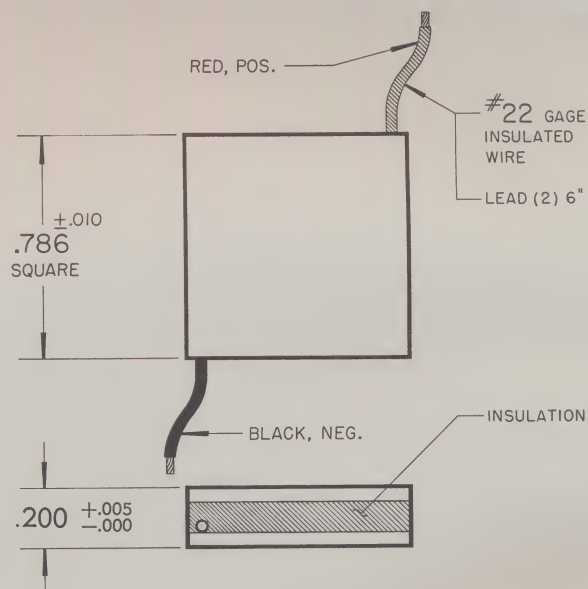
GENERAL CHARACTERISTICS

6.5 dc amperes 100% I optimum
 2.3 dc volts at $T_S = 27^\circ \text{C}$
 9 watts (30.6 BTU's/hour)
 heat pumping capacity at $T_S = 27^\circ \text{C}$

Size: 2cm x 2cm x .5cm

3954-1 is used to best advantage when mounted directly to a low thermal resistance heat sink. Forced convection heat sink systems with a thermal resistance of 0.1° to $0.3^\circ \text{C}/\text{watt}$ are recommended. Also advised is the use of liquid cooled (e.g., water) heat sinks where applicable.

Some application requirements are:
 AC ripple (10-15%); maximum allowable hot junction temperature ($T_S = 125^\circ \text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).



For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.

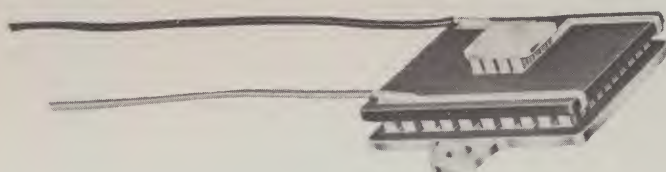
CAMBION® technical data

Model

3955-1

CAMBION'S

TWO STAGE CASCADED
THERMOELECTRIC
MODULE



PERFORMANCE

Ushering CAMBION into the cascaded thermoelectric field is model 3955-1. This TED* is a low-current, high heat pumping capacity, two-stage module. By employing the cascaded technique, CAMBION'S 3955-1 is able to yield a heat pumping capacity of approximately 1 Watt at a ΔT of 60°C. With the heat sink temperature (T_s) at 27°C, the maximum ΔT is 77°C at 5.2 dc amperes and 5.7 dc volts (still air, at atmospheric pressure, insulated). With the heat sink temperature at +50°C, a ΔT of 86°C is attained by this unit.

APPLICATIONS

CAMBION'S 3955-1 provides low cost, maintenance-free cold trap temperature for mass spectrometers; T_c lower than -60°C with $Q_c = 1$ watt, when operated in vacuum of 10^{-6} mm Hg at $T_s = 0^\circ\text{C}$ ($Q_c =$ heat of condensation pump oil vapor plus conduction leak through metal seams). In addition, it provides temperature control of infrared detectors and integrated circuits; test apparatus for MIL-SPEC conditions and for dew point hygrometry.

*Thermoelectric Device

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GENERAL CHARACTERISTICS

5.2 dc amperes 100% I optimum
 5.7 dc volts at $T_S = 27^\circ\text{C}$
 $Q_C = 1$ Watt at 60°C ΔT ,
 atmospheric pressure
 at $T_S = 27^\circ\text{C}$.

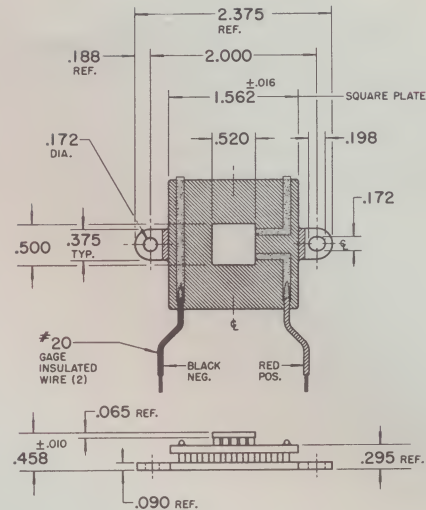
CAMBION Model 3955-1 is ruggedly constructed with the semiconductor elements permanently mounted between two aluminum plates. This procedure insures mechanical strength and uniformity of cold junction temperatures. The aluminum plates are electrically and thermally isolated.

Because of its low current requirements, Model 3955-1 may be operated by simply designed, low cost, yet efficient power sources while providing ample heat pumping capacity to handle a wide array of applications.

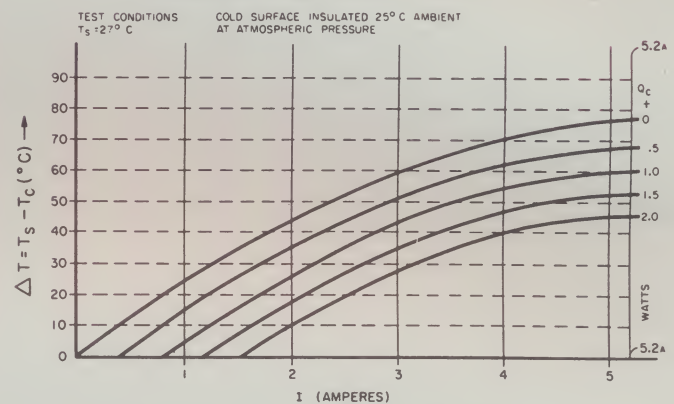
3955-1 is used to best advantage when mounted directly to a low thermal resistance heat sink. Forced convection heat sink systems with a thermal resistance of 0.1° to $0.3^\circ\text{C}/\text{watt}$ are recommended. Also advised is the use of liquid cooled (e. g., water) heat sinks where applicable.

Some application requirements are: AC ripple (10-15%); maximum allowable hot junction temperature ($T_S = 125^\circ\text{C}$); dielectric strength (top plate to bottom plate minimum 250 volts).

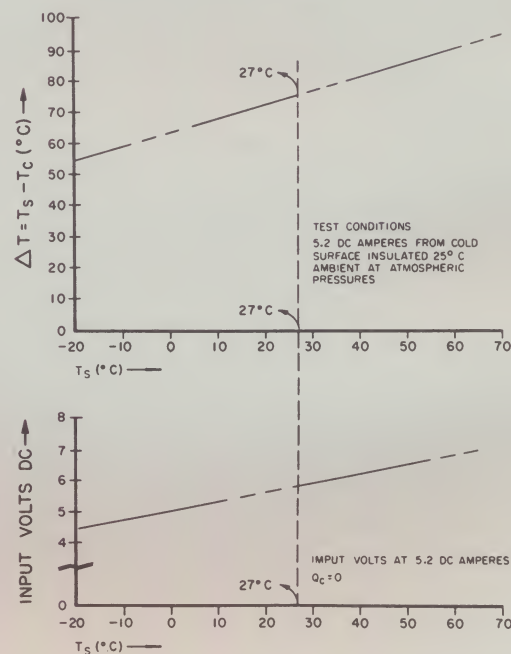
For additional information concerning characteristics and/or uses in a particular system, consult the thermoelectric engineering staff at CAMBION.



CAMBION TED MODEL 3955-1



CAMBION TED MODEL 3955-1



Standardize on CAMBION...the guaranteed electronic components

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IN THE EAST

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THERMOELECTRIC UNITS

Prices Each

<u>PART NO.</u>	<u>1-9</u>	<u>10-49</u>	<u>PART NO.</u>	<u>1-9</u>	<u>10-49</u>
<u>Components</u>			<u>Instruments (cont.)</u>		
3950-1	\$ 21.00	\$ 18.00	7221-1	\$ 359.50	- - -
3951-1 thru -4	32.00	27.00	7221-2	364.50	- - -
3951-5 thru -8	30.00	25.00	7221-3	369.50	- - -
3951-9 thru -12	36.00	30.50	7221-4	379.50	- - -
3951-13 thru -16	34.00	29.00	7222-1	399.50	- - -
3952-1	32.00	27.00	7222-2	404.50	- - -
3953-1 thru -4	32.00	27.00	7222-3	409.50	- - -
3954-1	21.00	18.00	7222-4	419.50	- - -
3955-1	95.00	70.00	<u>Assemblies</u>		
<u>Power Supplies</u>			3970-1	80.00	77.50
3971-1	49.50	45.00	7240-1	45.00	40.50
3972-1	49.50	45.00	7241-1	50.00	45.50
3973-1	49.50	45.00	7242-1	60.00	54.00
3974-1	49.50	45.00	7243-1	85.00	77.00
7230-1	159.50	149.50	7244-1	160.00	145.00
<u>Instruments</u>			7245-1	286.00	260.00
7200-1	169.50	- - -	7250-1	180.00	164.00
7201-1	229.50	- - -	7251-1	280.00	254.00
7210-1	199.50	- - -	<u>Covers</u>		
7211-1	249.50	- - -	7205-1	59.50	- - -
7212-1	289.50	- - -	7206-1	25.50	- - -
7213-1	349.50	- - -			
7220-1	299.50	- - -			
7220-2	304.50	- - -			
7220-3	309.50	- - -			
7220-4	319.50	- - -			

FOR LARGER QUANTITIES, PLEASE CONTACT THE FACTORY.

Minimum Billing: \$20 per Shipment
Prices subject to change without notice.

Terms: Net 30 Days
FOB: Our Factory, Cambridge

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